NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

SUPPLEMENTAL TO THESIS
(2 of 2: REDSTONE SECCM TOOL USER GUIDE)

DEVELOPMENT OF A SYSTEMS ENGINEERING COMPETENCY MODEL TOOL FOR THE AVIATION AND MISSILE RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER (AMRDEC)

by

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Redstone Systems Engineering Career Competency Model Tool

User Guide

Version 1

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1.0 How to Use this Guide

This User Guide is an instruction for using the Redstone Systems Engineering Career Competency Model Tool, developed and managed by Systems Engineering students within the Naval Postgraduate School, Monterey, CA. Although this guide is intended to guide the development of a competency model within a specific tool, many of the steps and procedures can be applied to any general competency model development effort, regardless of tool used. This chapter will document:

- The intended audience of the Redstone SECCM Tool
- A brief overview of the OPM developed Systems Engineering Career Competency Model
- A brief overview of the Redstone SECCM Tool and its usage
- A discussion on Top-down or Competency Driven development of a Competency Model
- A discussion on the Bottom-Up or Task Driven development of a Competency Model
- An implementation example using the tool

1.1 Intended Audience

This User's Guide will guide the user in the development of a competency model using the Redstone SECCM Tool. The following are the intended audience of the User's Guide:

- Supervisors of Systems Engineering Personnel
- Hiring Managers
- Organizational Planners
- Systems Engineering Personnel

This tool can be used in the development, tracking, and recognition of Systems Engineering Competencies for personnel who work with Systems or are identified as Systems Engineers. Supervisors and Organizational Planners are tasked with developing personnel who have the skills needed to meet the changing needs of a system during its lifecycle. Supervisors and Hiring Managers are tasked with developing a competencies list that can be used in selecting the most capable employees. Systems engineering personnel can track their careers and receive recognition within their organization for meeting expected and defined competencies.

1.2 OPM Systems Engineering Career Competency Model

The OPM Systems Engineering Career Competency Model for the Army is defined in the report "Army Occupational Analysis for the Systems Engineer Position", OPM. This document, released in late summer of 2016, identifies the method that was applied in order to create the list of Systems Engineering competencies and tasks. A competency is defined as "an observable, measurable pattern of skills, knowledge, abilities, behaviors and other characteristics that an individual needs to perform work roles or occupational functions successfully" (OPM). Tasks are activities an employee performs on a regular basis in order to carry out the functions of the job (OPM). Tasks and competencies should be linked by subject matter experts to demonstrate the job-relatedness of each competency (OPM). There are 179 tasks and 44 competencies identified as core SE competencies. Each competency is defined, and there is a table that identifies the expected competencies based on General Schedule Pay Grade. Hiring managers now have access to these OPM supported and defined competencies to be used in position descriptions for Systems Engineers. By linking local, organizational level competencies to these higher level Army competencies, hiring managers have more flexibility and credibility to create accurate job descriptions based on defined Systems Engineering tasks.

1.3 Redstone Systems Engineering Career Competency Model Development Tool

In August 2016, a team of systems engineering graduate students at Naval Postgraduate School was tasked with exploring the application and utility of the OPM SECCM at an organizational level. This is in response to the intended use of the OPM SECCM as a high-level guide based on the systems engineering field and the expected use for in providing organizations with a consistent basis to define more specific competency statements applicable to their local needs. A list of needs for a local organizational competency model were compiled after identifying and interviewing multiple stakeholders within U.S. Aviation and Missile Research, Development, Engineering Center (AMRDEC), Program Executive Office Missiles and Space (PEO MS), and the CP-16 office within Army Materiel Command (AMC). The feedback overwhelmingly recommended an adaptable Systems Engineering Career Competency Model that can be defined and managed locally at the organizational level. The Redstone SECCM Tool was identified along with this User's Guide as the most user-friendly method of tracking local competencies while retaining their lineage to Army level competencies. This tool is excel-based

and utilizes a wizard to help guide the user through task development and identification of lineage from OPM SECCM competencies to a local competency model. Two methods are described for the development of local competency models, bottom up and top down. The bottom up approach assumes that the user has or can create a list of tasks or local competencies that are needed for a specific model. The top down approach would include all local competencies within an organization as well as built-in linkage between OPM competencies and local competencies. This approach is more suited for creation of an organizational level model in which managers could focus on high-level needs. Chapter 2.0 Developing a New Systems Engineering Competency Model will guide the user through the development of a Bottom-Up competency model. The Bottom-Up or Competency Driven approach is further defined in section 1.4 Bottom-Up (Competency Driven) Competency Development Approach. The Top-Down, or Task Driven approach, is not included in the tool but is briefly discussed in section 1.5 Top-Down (Task Driven) Competency Development Approach.

1.4 Bottom-Up (Competency Driven) Competency Development Approach

The Bottom-Up approach begins with a list of tasks or local competencies that are needed for a specific model. These tasks or local competencies can be traced back to the OPM SECCM using the Systems and Software Engineering standard ISO/IEC/IEEE 15288 as a guide. Figure 1. Bottom-Up Approach shows a visual example of the flow from local competency up to an OPM competency using the INCOSE Handbook and ISO/IEC/IEEE 15288. The Redstone SECCM Tool is intended to guide the user as the local competencies are linked to higher-level competencies and metrics are defined for each competency.

To develop a competency model using the Bottom-Up approach within the Redstone SECCM Tool, the user is expected to input the tasks/local competencies needed for the model and to manually identify the OPM competencies to which each task will be traced. Future iterations of the tool may provide an approach that allows the user to choose from a list of SE methodologies and create the traceability automatically.

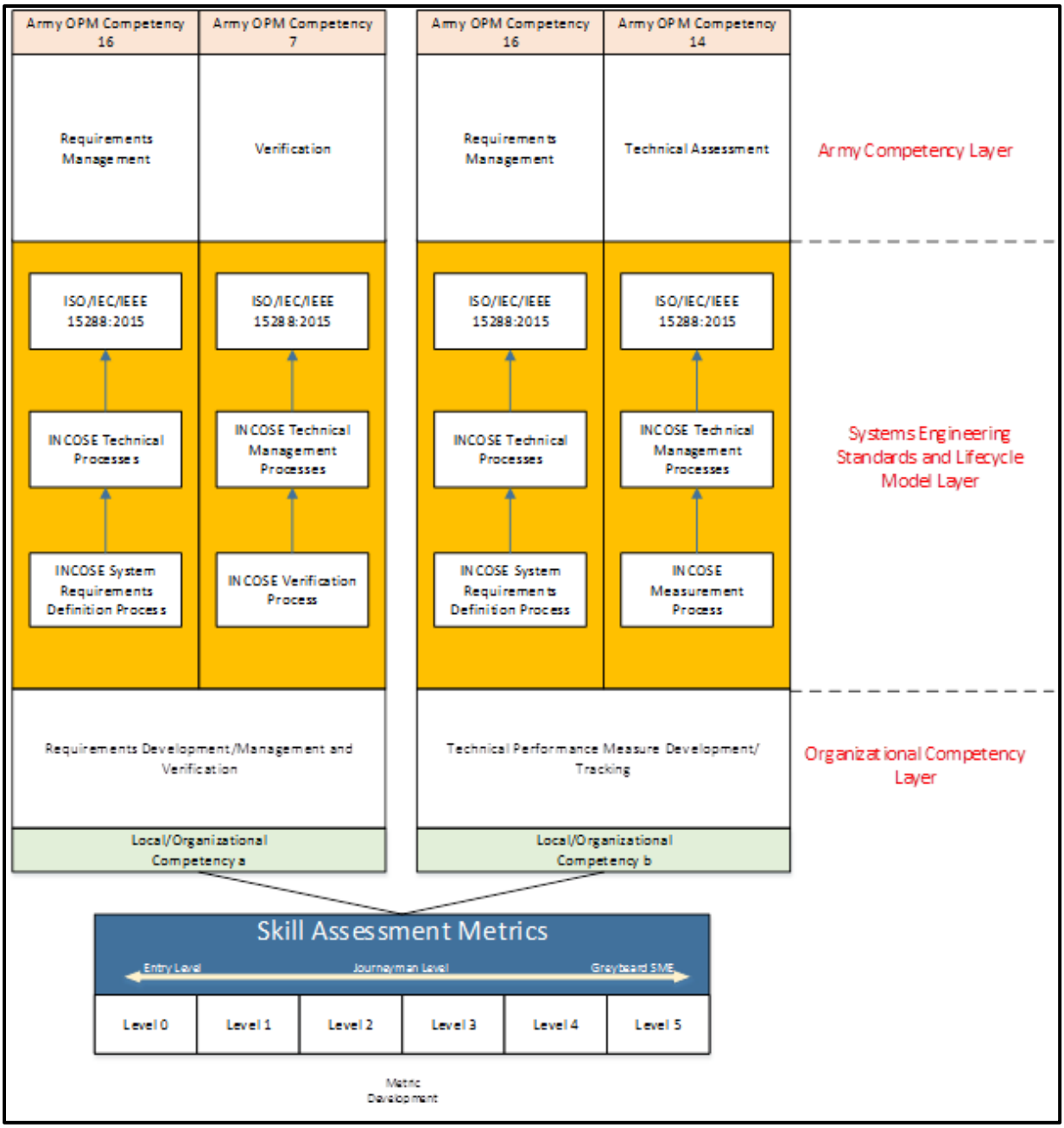


Figure 1. Bottom-Up Approach

1.5 Top-Down (Task Driven) Competency Development Approach

The Top-Down approach assumes that the user is basing a new competency model off of an existing higher level model (organization, division, etc.) but does not have an existing task list for systems engineers. This approach is not currently implemented in the tool but should be discussed as it has applicability in some cases. Figure 2. Top-Down Approach is a visual representation of the flow from OPM Competency down to a local or organizational competency. What is missing from this top-down approach diagram are potential interim competencies at the organizational or lower level. In some cases, the organization (for example: AMRDEC) may develop a list of competencies that trace to the OPM model but are still at a higher level than which an employee can be tracked. These organizational competencies can be further broken down to lower level organizations and finally to the local organization. This would be most efficiently accomplished using a listing of all competencies within an organization. Unfortunately, the effort to accurately define all efforts across AMRDEC is outside the scope of this effort. If further research were to be requested, the Top-Down approach could be implemented into the tool in the manner described in this section.

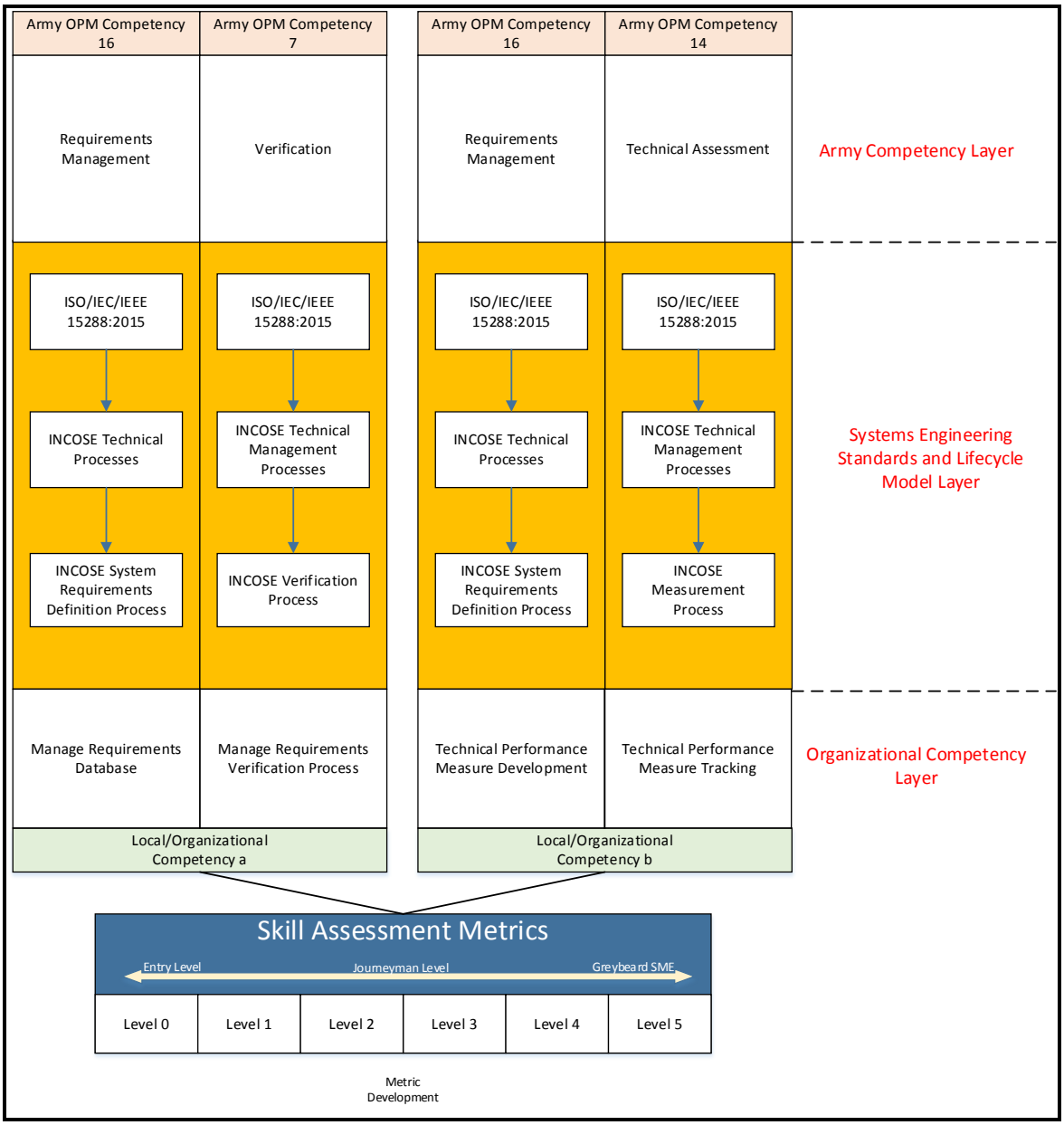


Figure 2. Top-Down Approach

2.0 Developing a New Systems Engineering Competency Model

This section is designed to lead the user through the creation of a new Systems Engineering Competency Model. Stating with a brief introduction of the tool and its functionality, this section will cover the topics of creating new base model, defining competencies, developing competency levels, linking competencies to OPM model, and, finally, employee competency management – creating an employee model

2.1 Getting Started

The Redstone SECCM Tool is a Microsoft Excel-based tool written in VBA coding language that provides the ability to create and update an organizational level competency model and customized individual employee competency models. The first screen that allows the user to enter the tool is shown in Figure 3. Redstone SECCM Tool Start Screen. Selecting the Start button produces the Welcome screen shown in Figure 4. The Welcome screen allows the user to select tool options. The options are briefly described in the following sections. Each selection listed in Figure 4. Welcome Screen is explained in the in detail either in this section or in Section 3.0 Updating an Existing Competency Model. There are several normal functions available within the tool. The tool provides back buttons to allow the user to return to the previous screen/step as needed during tool use. Please note that use of the back button may remove data already entered and require it to be entered again.

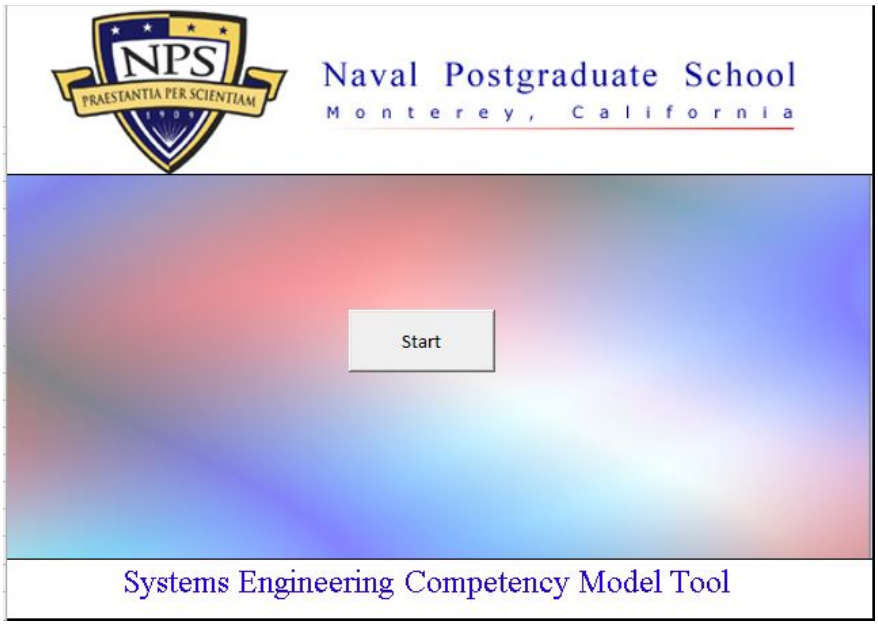


Figure 3. Redstone SECCM Tool Start Screen

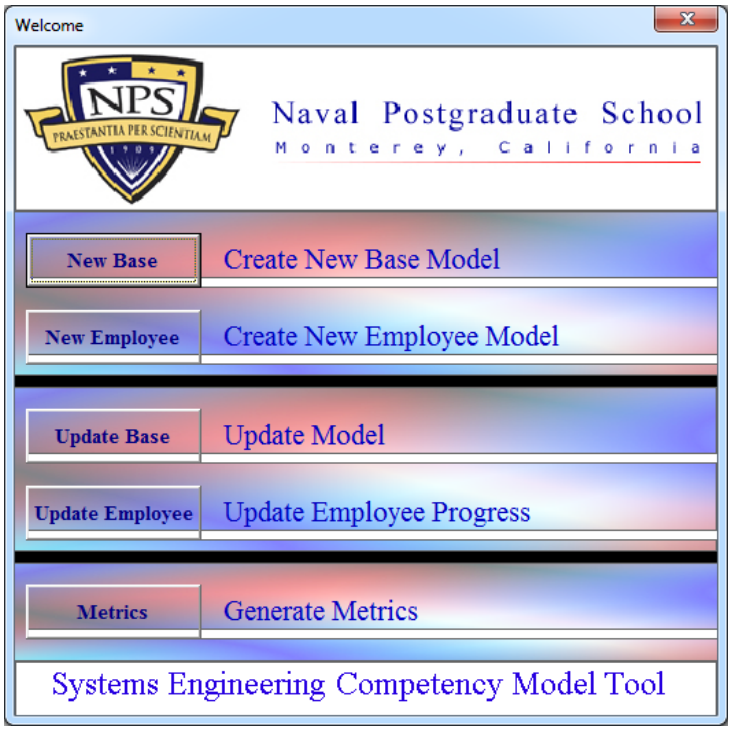


Figure 4. Welcome Screen

2.2 Creating New Base Model

The 'New Base' button allows the user to create a new base competency model. This option walks the user through the steps necessary for the creation of the model. From the Welcome screen, select this button to start creating a new model. The next screen is shown in Figure 5 and allows the user to create the name of the new model.

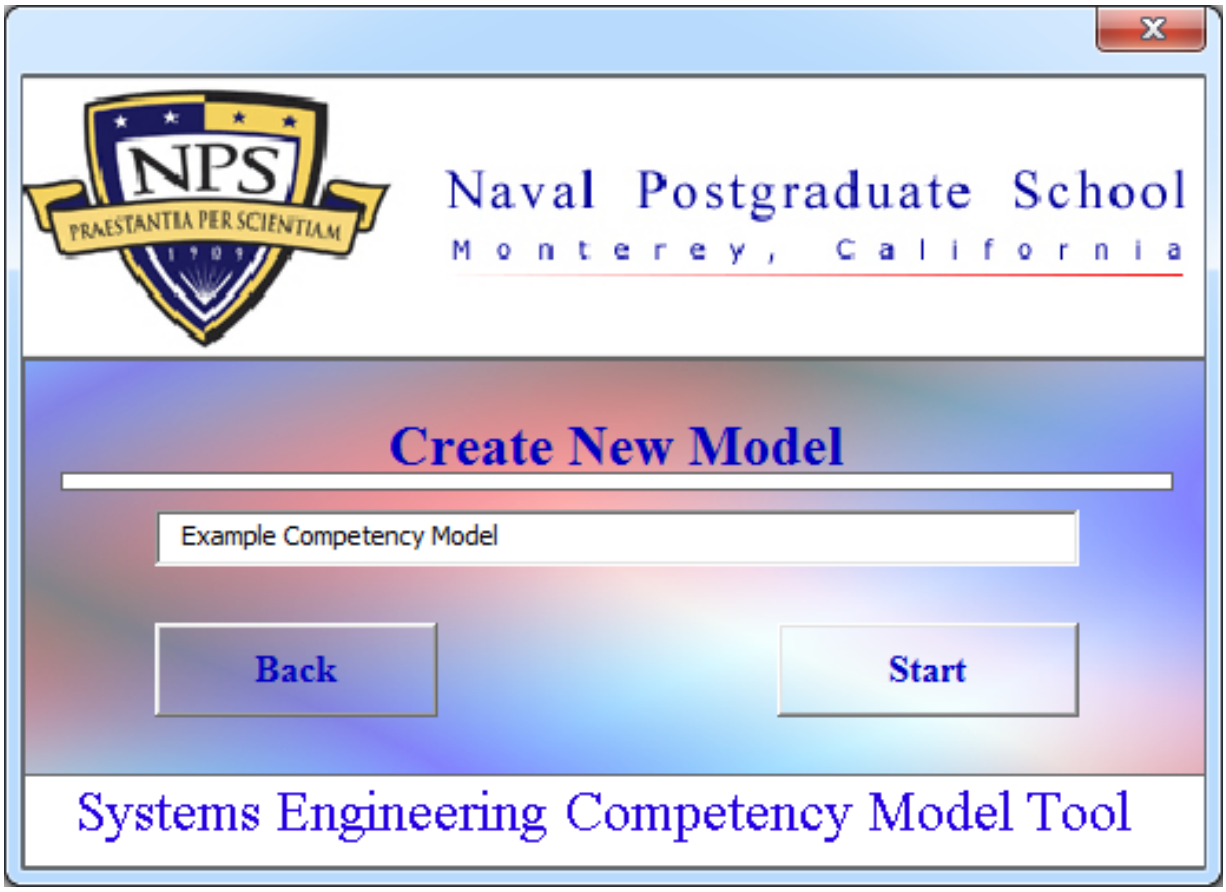


Figure 5. Create New Model Name

Once the Start button is selected the tool displays the 'Build Direction' screen, show in Figure 6 that provides an overview of the tool capabilities. The two options are discussed in more detail in Section 1.0 How to Use this Guide of this guide. As noted, the Competency Driven option is currently disabled. Select the Next button to continue.

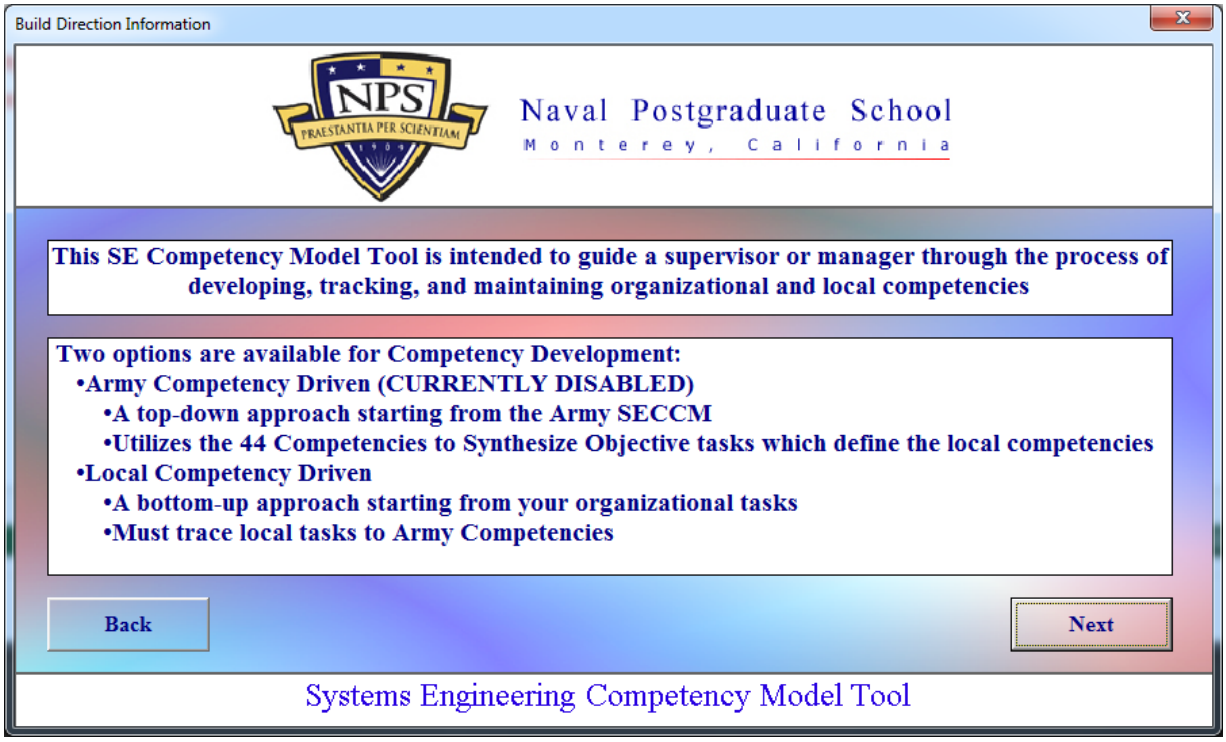


Figure 6. Build Direction Screen

2.3 Defining Competencies

The next screen, Figure 7, shows that the Top Down option is not currently available and the Bottom Up option is already selected. Future option: This screen will be used to select the two options for building a competency model.

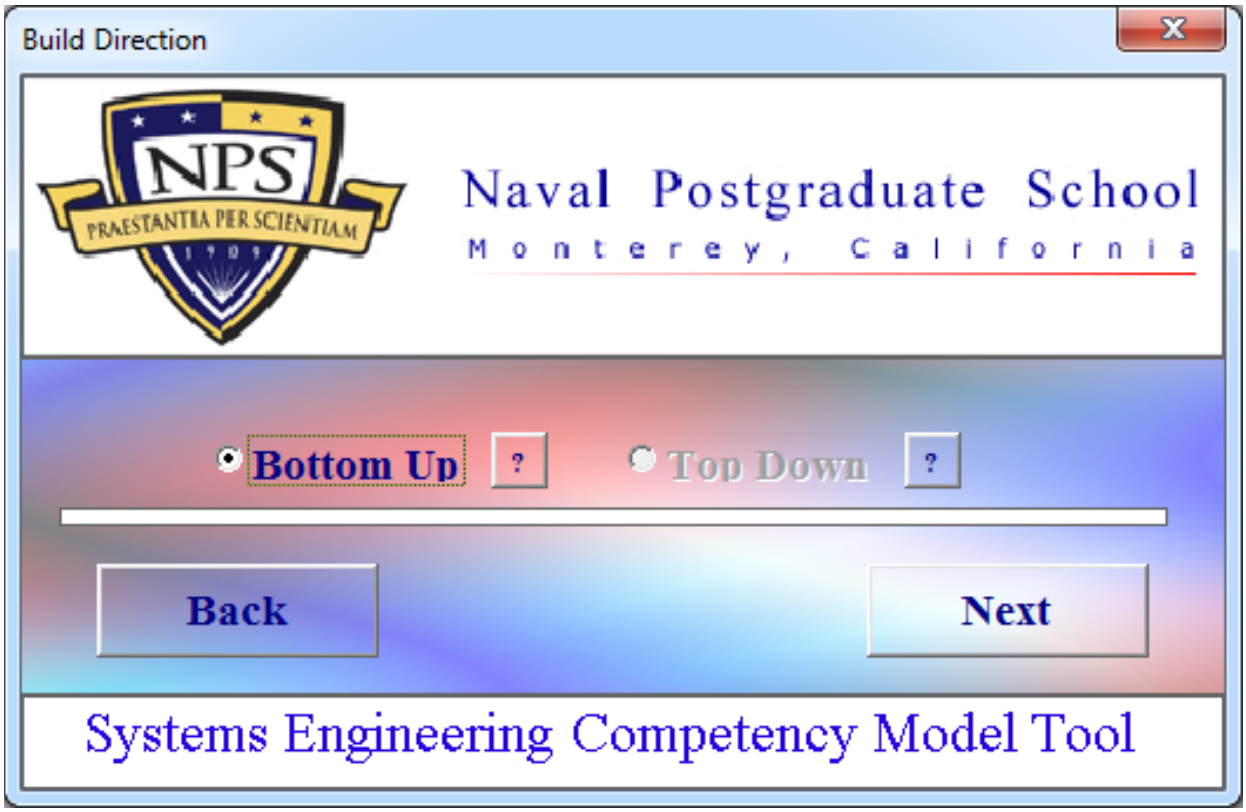


Figure 7. Build Direction Selection Screen

Selecting the Question Mark button beside the Bottom Up selection provides an example of the Bottom Up flow model shown in Figure 8. Select 'Next' to continue to the 'What Competencies define your Organizational Operations' screen shown in Figure 9. The screen provides examples of potential competencies that can be entered into the model for tracking. Select 'Next' to continue.

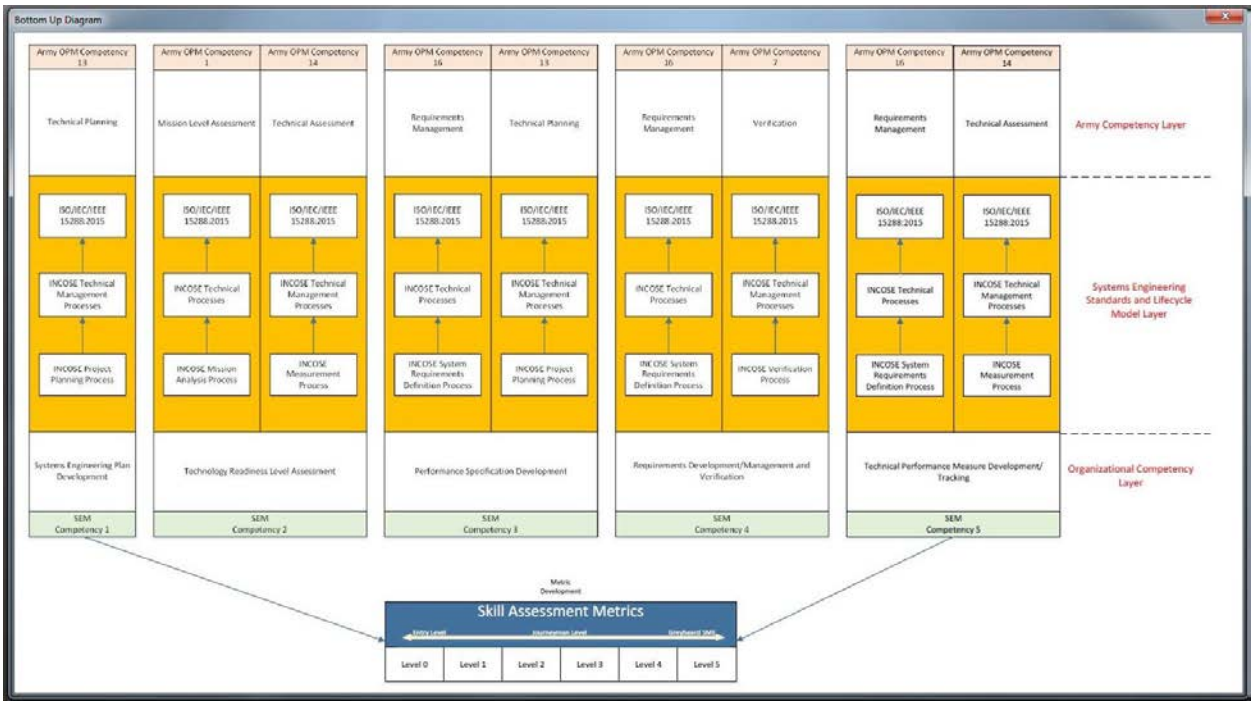


Figure 8. Bottom-Up Example

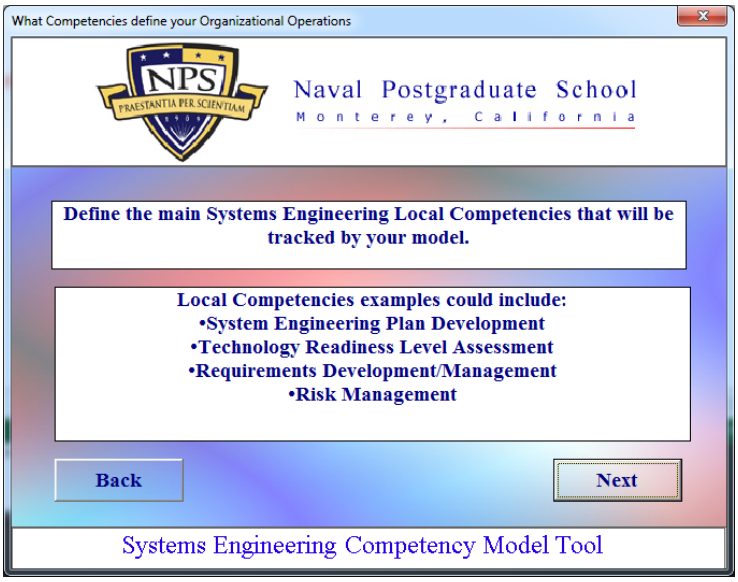


Figure 9 What Competencies…Screen

The 'Enter Local Competencies' screen, show in Figure 10, lets the user enter the competencies one at a time to the model. This screen provides the user several options for the creation of new competencies.

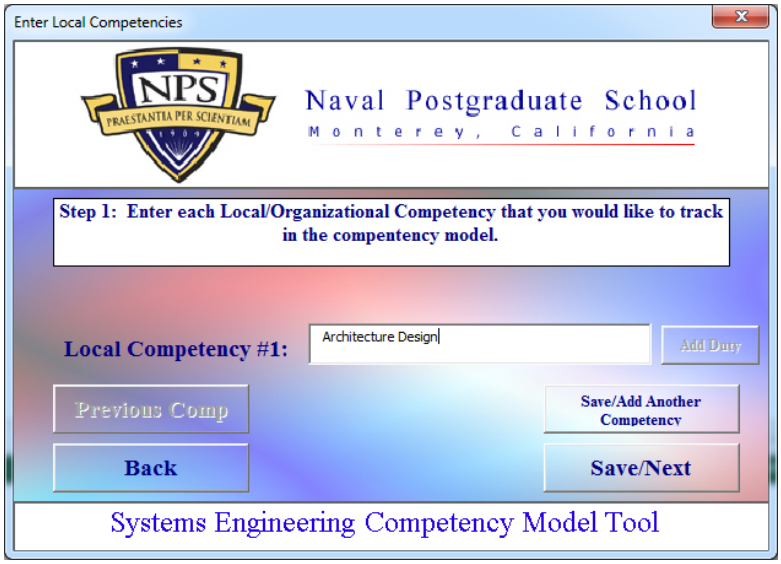


Figure 10 Enter Local Competencies

The Local Competency # is the competencies that the user is intending to enter into the model that was just created. The 'Save/Add Another Competency' button allows the user to enter additional competencies into the model from this screen. The 'Save/Next' button takes the

user to the next screen. Once the user is done entering additional competencies, select the 'Save/Next' button to continue. As the competencies are added to the model, they can be seen on the left of Figure 11.

Note: The user can make changes/modify/add/delete competencies directly in the model after the creation of the base model using the wizard.

Figure 11 Model Details

2.4 Developing Competency Levels

The Competency Levels screen, shown in Figure 12, provides examples for creating the levels to be used for mapping the competency skill levels for an employee. There are several concepts for creating competency levels that the user may find useful. First, although the tool can be used with any number of proficiency levels up to six (6), it works best when there is a consistent number of levels used across all competencies. This will help create a uniform model that is easy to understand and interpret. The second is to be consistent in describing the levels between the competencies. This may also help in understanding and interpreting areas that need improvement. Select the Next button to continue.

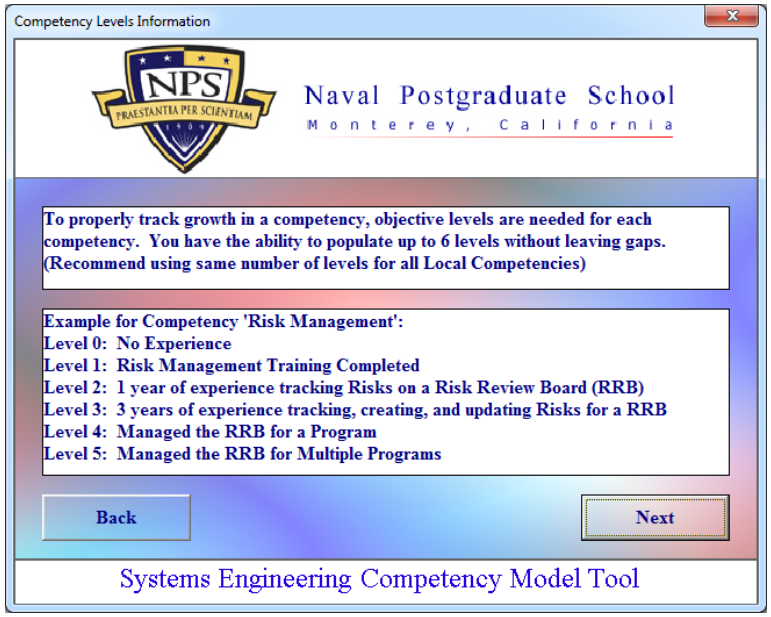


Figure 12 Competency Levels Screen

The Competency Level Description screen, shown in Figure 13, lets the user define the different levels for the competencies. The tool will increment starting at competency #1 through the list of existing competencies in the model. Note: The tool allows for the user to identify up to 6 levels (0-5) but the user can specify less than 6. Please do not leave any gaps between the levels. The use of the 'Back' button at this point will take the user back to the previous screen, Figure 12, and drops any data entered, which will require reentry of the data. The 'Next' and 'Previous' buttons allow the user to move between competencies to make corrections or changes to the level details.

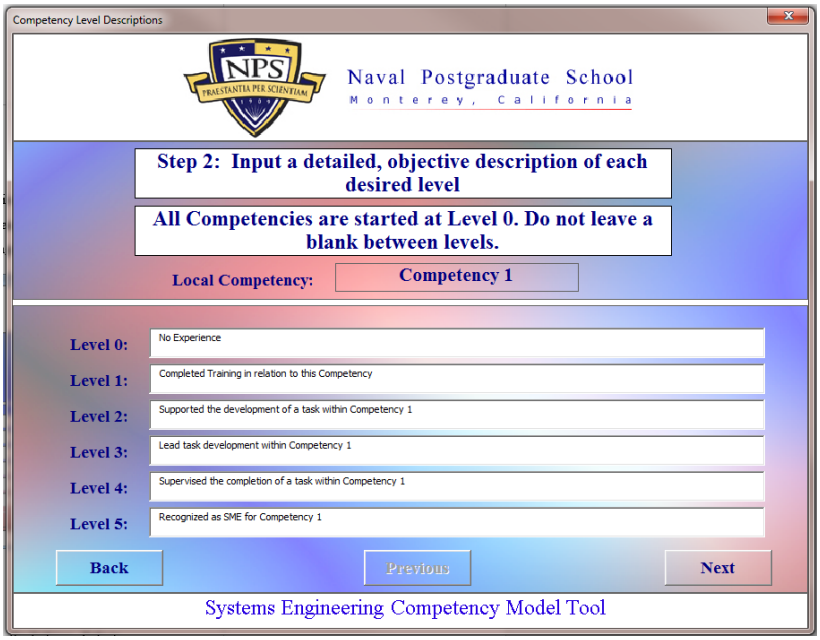


Figure 13 Competency Level Descriptions Screen

2.5 Linking Competencies to OPM Model

The Link to OPM's Model screen, shown in Figure 14, provides details on the linking. Select Next to continue.

Figure 14 Link to OPM's Model Description Screen

The Link to OPM Model, shown in Figure 15, shows both the SE and General Competencies that are available for linking to each competency separated on tabs. The link is established by selecting the check box by each of the competencies on one or both tabs as required. The Def button provides the OPM definition for each competency and should be reviewed as part of the selection process as the definitions are somewhat deterministic. The Clear All button will clear all the selections that have been made for this competency. The competencies selection can then be restarted. Selecting the Next button will advance to the next available task in the model. The button name will change to "Done" when all tasks have been completed.

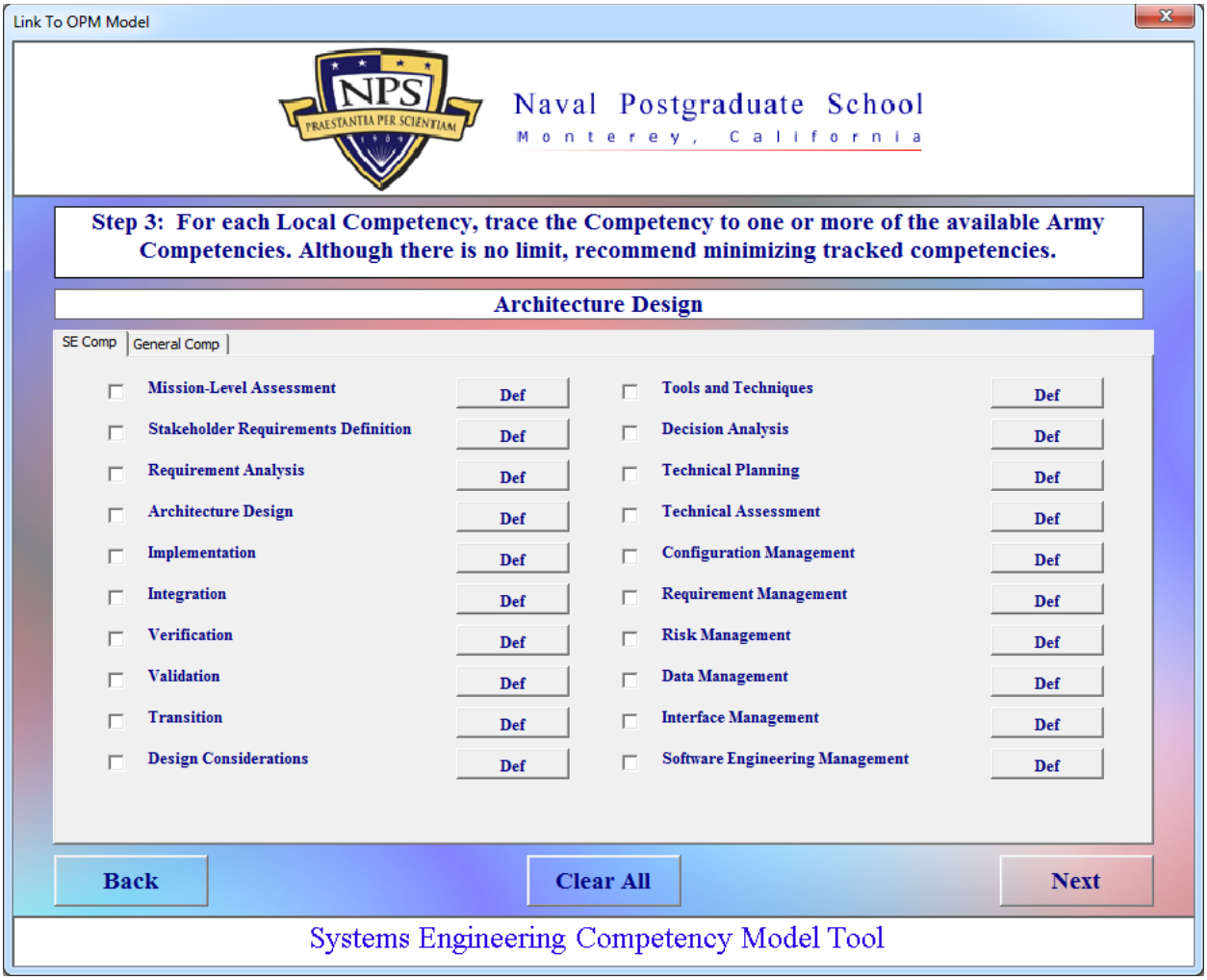


Figure 15 Link to OPM Model Selection Screen

The resulting model looks like Figure 16. There are several controls available within the model that allows the user to make changes directly in the model. The Add New Competency button allows the user to add a new task/duty to the model and will step the user through creating the linkage to the OPM competencies. The Remove Competency button removes that associated competencies including the level and linkage information.

Figure 16 New Model with Example Data

2.6 Employee Competency Management – Creating Employee Model

The competency model allows the user to track the employee's progress against the levels associated with each competencies. The first step is to create an employee model using the New Base Model previously created. This employee model provides a means of tracking employee progress in developing skills against the competencies through training and experience. The intended utilization of these metrics is to identify areas for improvement that need to be address in improving the employee skill level in specific areas defined by the competencies.

To create the employee model, the user must begin at the 'Start' screen, Figure 3, and select 'New Employee' shown on Figure 4. The Create New Employee screen, shown in Figure 17, requires that the Base model be selected first and then entering the employee name. Once the selection and name are entered, select the Open button to create the employee model using the

base model competencies. The employee model is created showing the associated competencies from the base model. The model exists as a tab in Excel as shown in Figure 18.

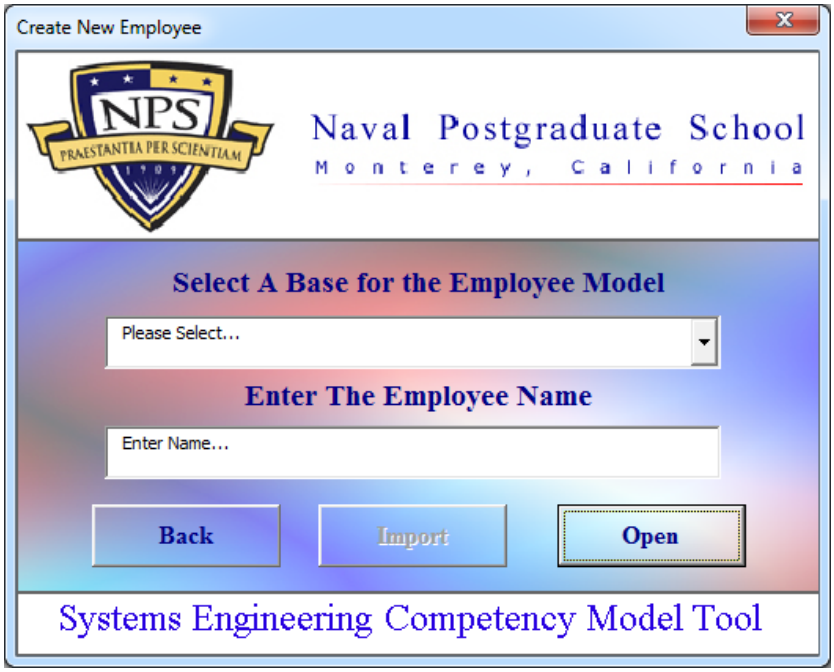


Figure 17 Create New Employee Screen

Figure 18 Created Employee Model

The ‘Update Progress’ button allows the user to update the progress of an employee for each level for a competency. ‘Update Progress’ progresses left to right one cell at a time. The details of developing employee progress is addressed in more detail in the next section.

3.0 Updating an Existing Competency Model

Updates can be made to a base model and employee model after initial creation. Updates include adding, deleting, and modifying both local competencies and competency levels, as well as employee progress within a particular local competency.

3.1 Getting Started

Users have main options for updating a competency model: update a base model or update an employee model. Figure 19 shows these two options via the Update Base and Update Employee buttons. The main difference between the two options is that updating an employee model also includes increasing a level that the employee is currently at for a local competency.

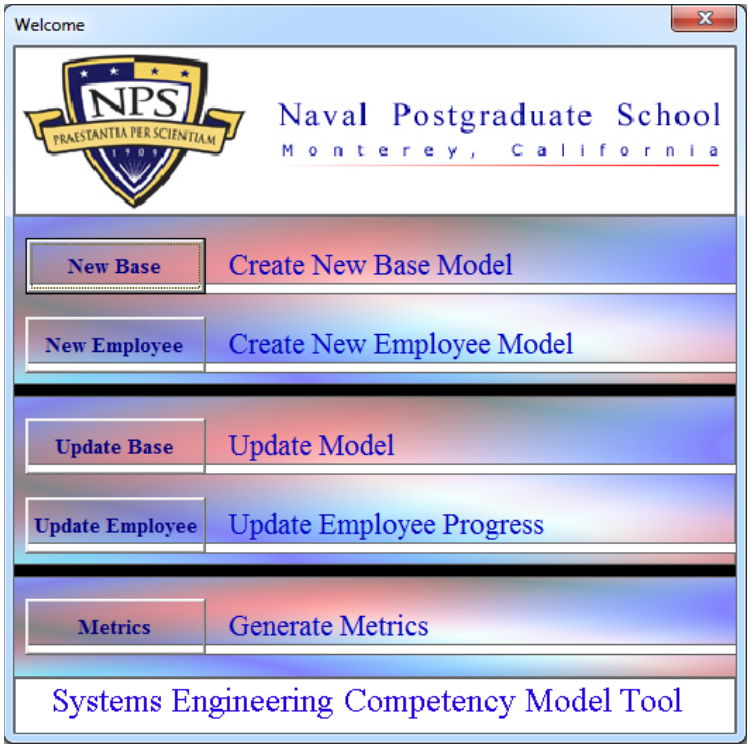


Figure 19 - Welcome Screen

3.2 Update Base Model

Selecting the Update Base button brings up the Update Base Model screen as show in Figure 20. From this screen, the user can select which base model to update via the drop down list box.

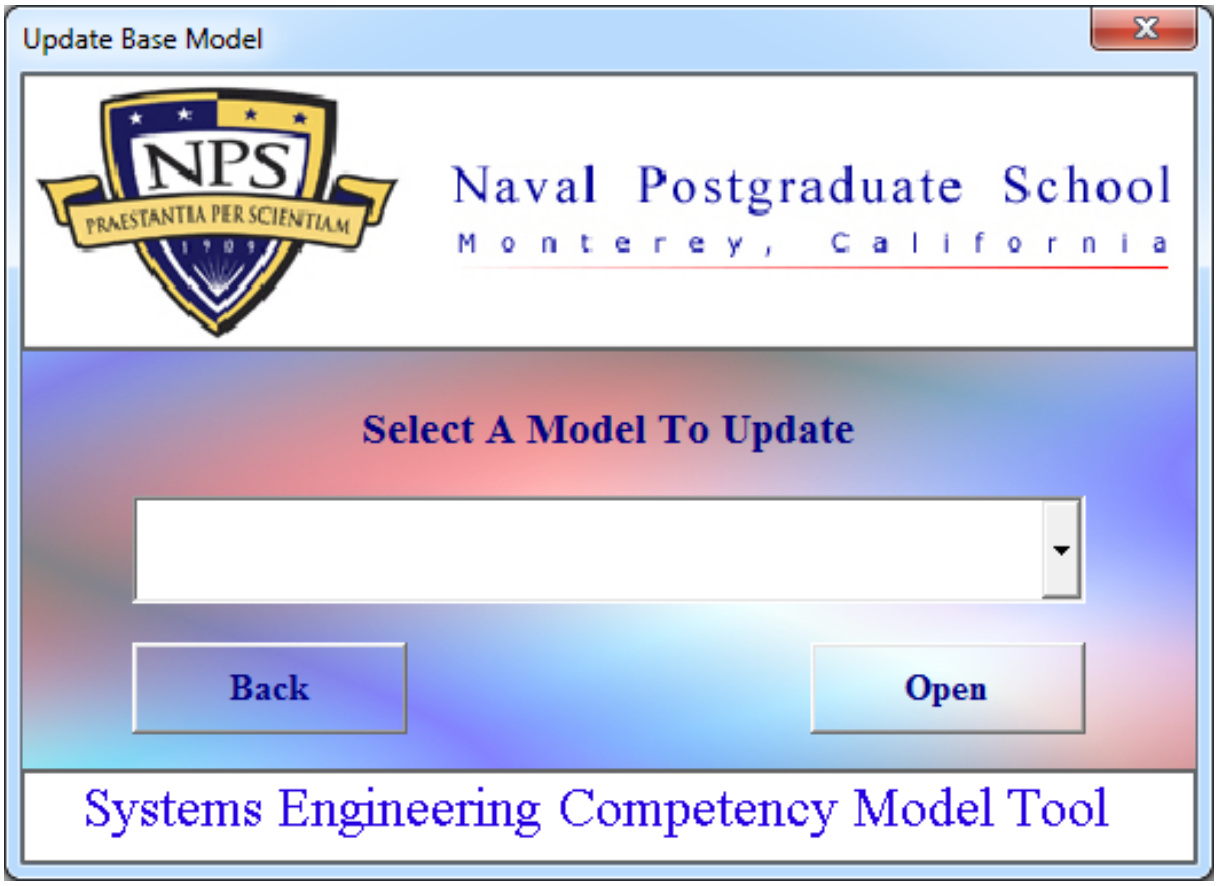


Figure 20 - Update Base Model

Select the model to update as show in Figure 21 and then select the Open button.

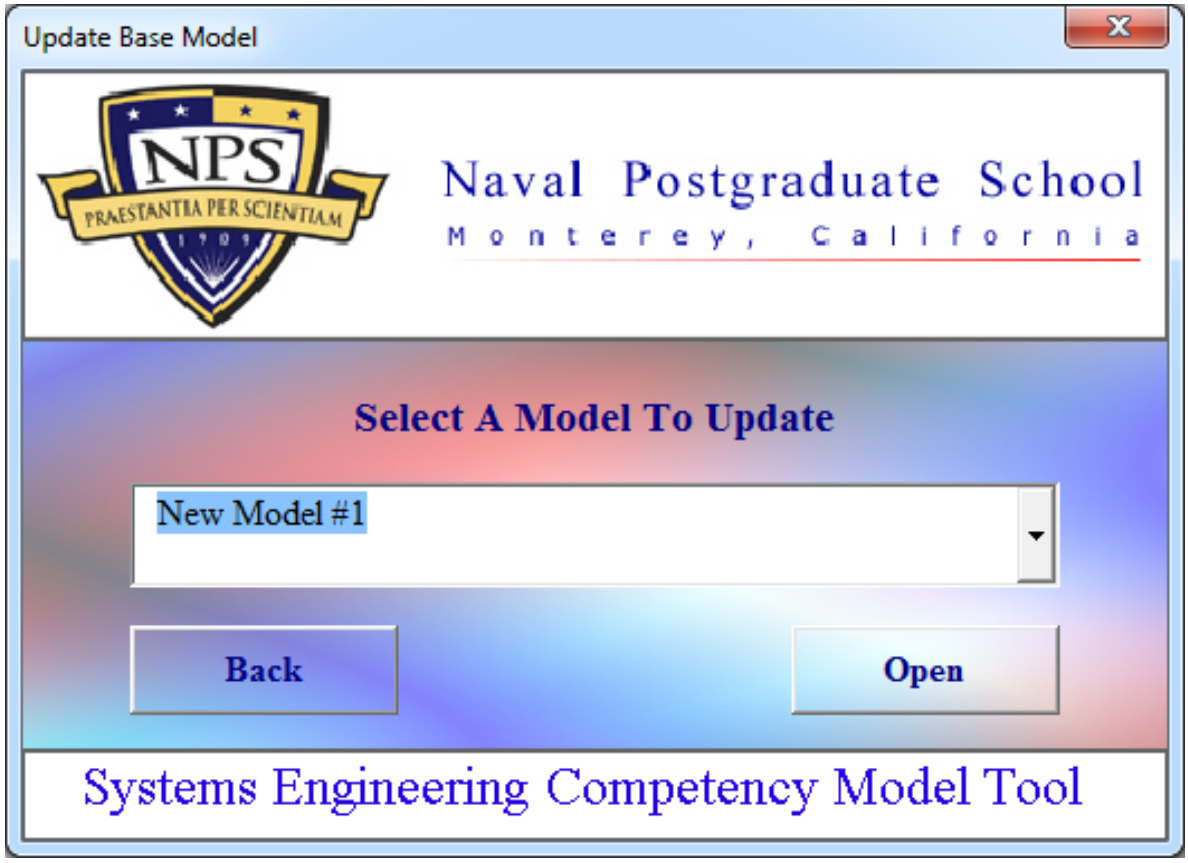
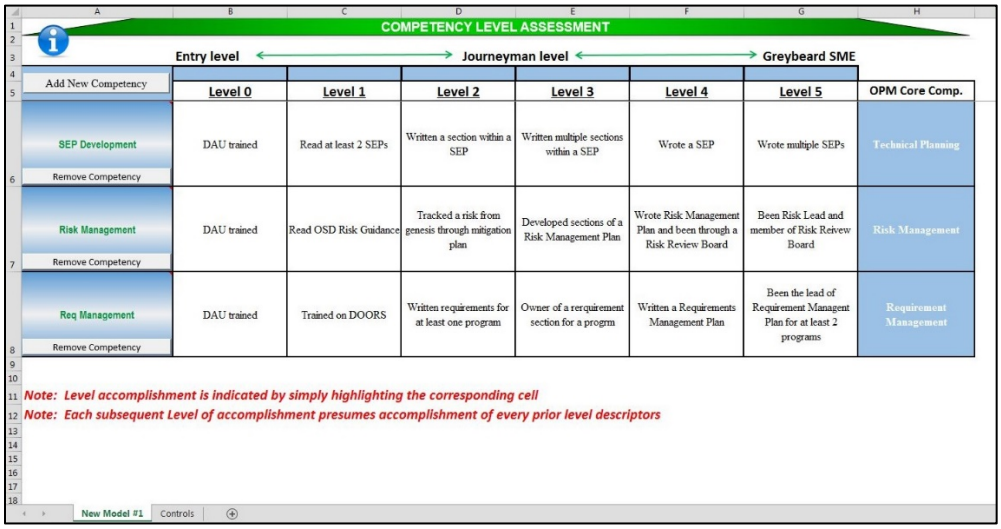


Figure 21 - Select Base Model Name

By selecting the Open button, the sheet containing the selected Base Model opens as shown in Figure 22.



COMPETENCY LEVEL ASSESSMENT

Entry level ⟷ Journeyman level ⟷ Greybeard SME

Add New Competency	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	OPM Core Comp.
SEP Development / Remove Competency	DAU trained	Read at least 2 SEPs	Written a section within a SEP	Written multiple sections within a SEP	Wrote a SEP	Wrote multiple SEPs	Technical Planning
Risk Management / Remove Competency	DAU trained	Read OSD Risk Guidance	Tracked a risk from genesis through mitigation plan	Developed sections of a Risk Management Plan	Wrote Risk Management Plan and been through a Risk Review Board	Been Risk Lead and member of Risk Reivew Board	Risk Management
Req Management / Remove Competency	DAU trained	Trained on DOORS	Written requirements for at least one program	Owner of a rerquirement section for a progrm	Written a Requirements Management Plan	Been the lead of Requirement Managent Plan for at least 2 programs	Requirement Management

Note: Level accomplishment is indicated by simply highlighting the corresponding cell

Note: Each subsequent Level of accomplishment presumes accomplishment of every prior level descriptors

New Model #1 | Controls

Figure 22 - Base Model Sheet

Any of the text can be manually updated by simply clicking on the cell and modifying the text. The user has two automated options to update a base model. Each local competency row has a 'Remove Competency' button located in it. By selecting 'Remove Competency', the user removes that particular competency from the base model. For example, if the 'Remove Competency' button were selected for Req Management, then the following warning message as shown in Figure 23 is presented for the user to verify that the selected competency should be deleted.

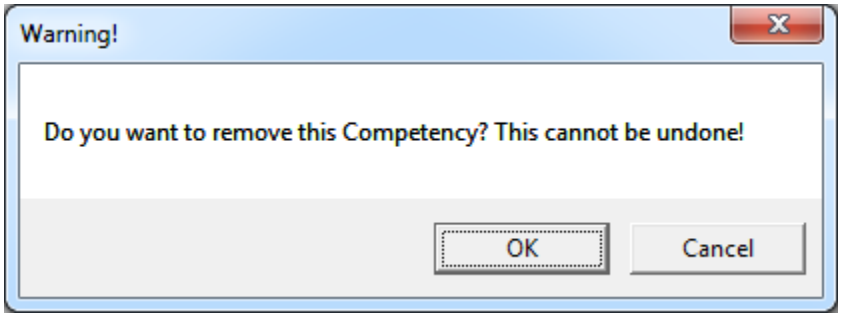


Figure 23 - Deletion Warning

Select ‘OK’. The Req Management competency is deleted as shown in Figure 24.

COMPETENCY LEVEL ASSESSMENT

Entry level ⟷ Journeyman level ⟷ Greybeard SME

Save | Close

Add New Competency

	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	OPM Core Comp.
SEP Development Remove Competency	DAU trained	Read at least SEPs	Written a section within a SEP	Written multiple sections within a SEP	Wrote a SEP	Wrote multiple SEPs	Technical Planning
Risk Management Remove Competency	DAU trainted	Read OSD Risk Guidance	Tracked a risk from genesis through mitigation plan	Developed section of a Risk Management Plan	Wrote Risk Management Plan and been through a Risk Review Board	Been Risk Leadand memeber of a Risk Review Board	Risk Management

Note: Level accomplishment is indicated by simply highlighting the corresponding cell

Note: Each subsequent Level of accomplishment presumes accomplishment of every prior level descriptors

Figure 24 - Local Competency Deleted

By selecting the ‘Add New Competency’ button, the user is presented with form shown in Figure 25.

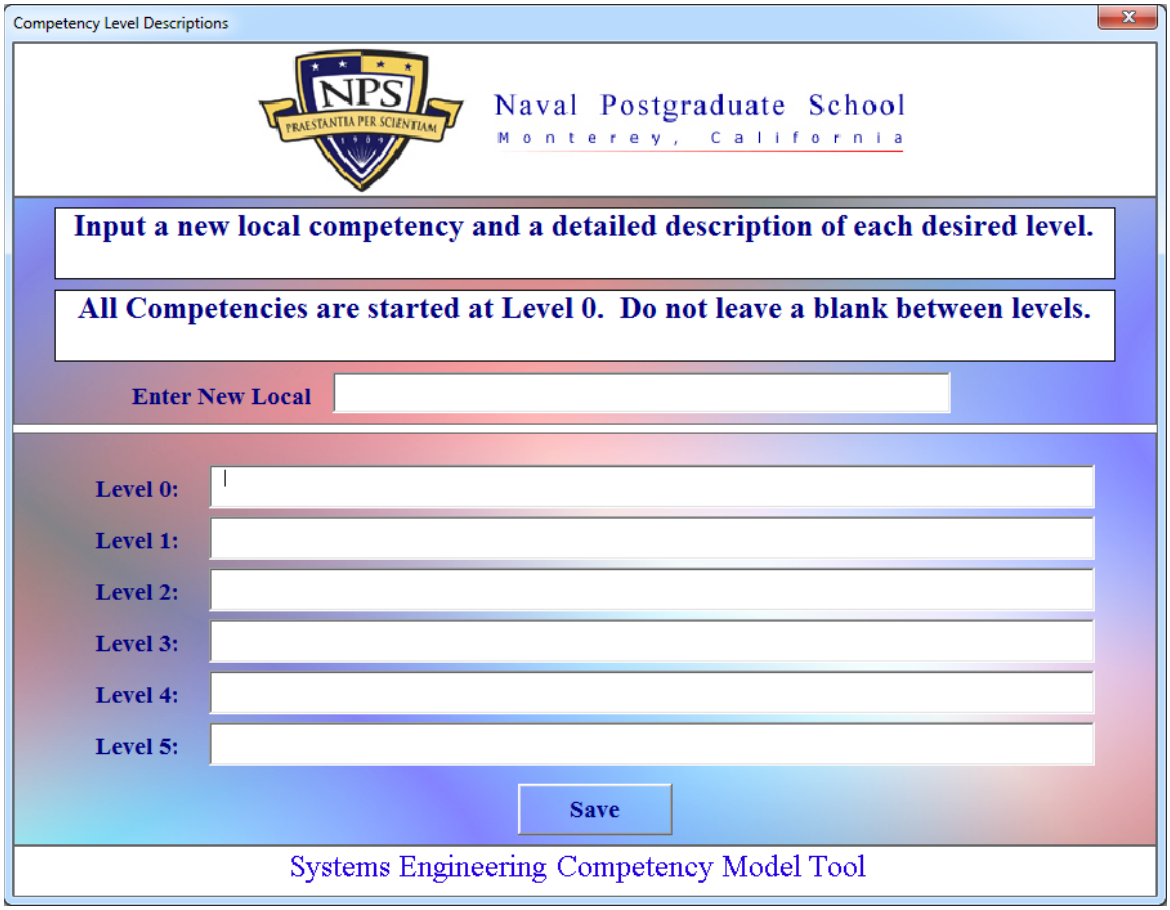


Figure 25 - Add New Local Competency

The user enters a new local competency name along with object descriptions for each level as done in creating the base model. Figure 26 shows an example local competency and level descriptions.

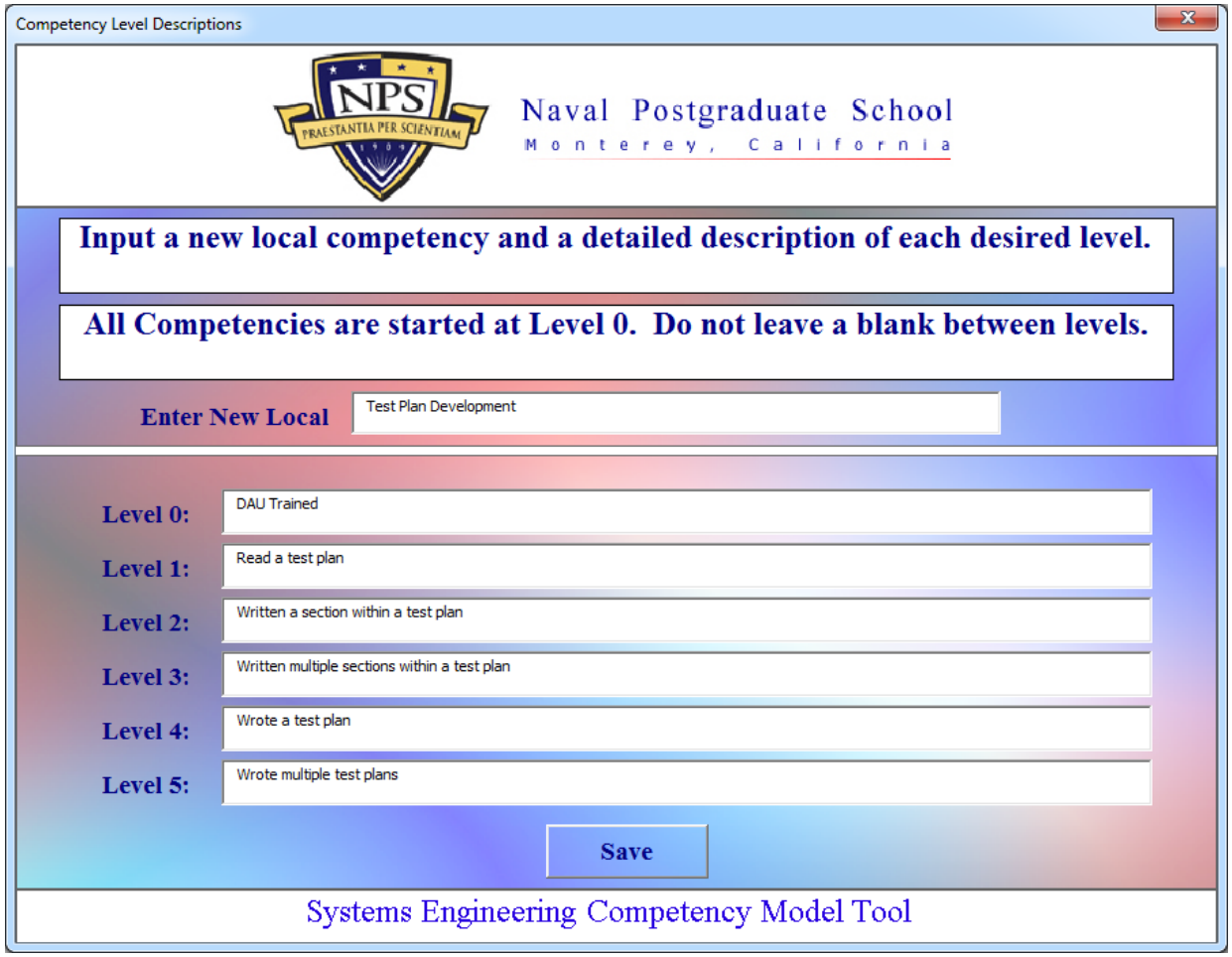


Figure 26 - Add New Local Competency Example

The user then selects ‘Save’ and the Link To OPM Model form as shown in Figure 27 is presented again as it was in building a new base model.

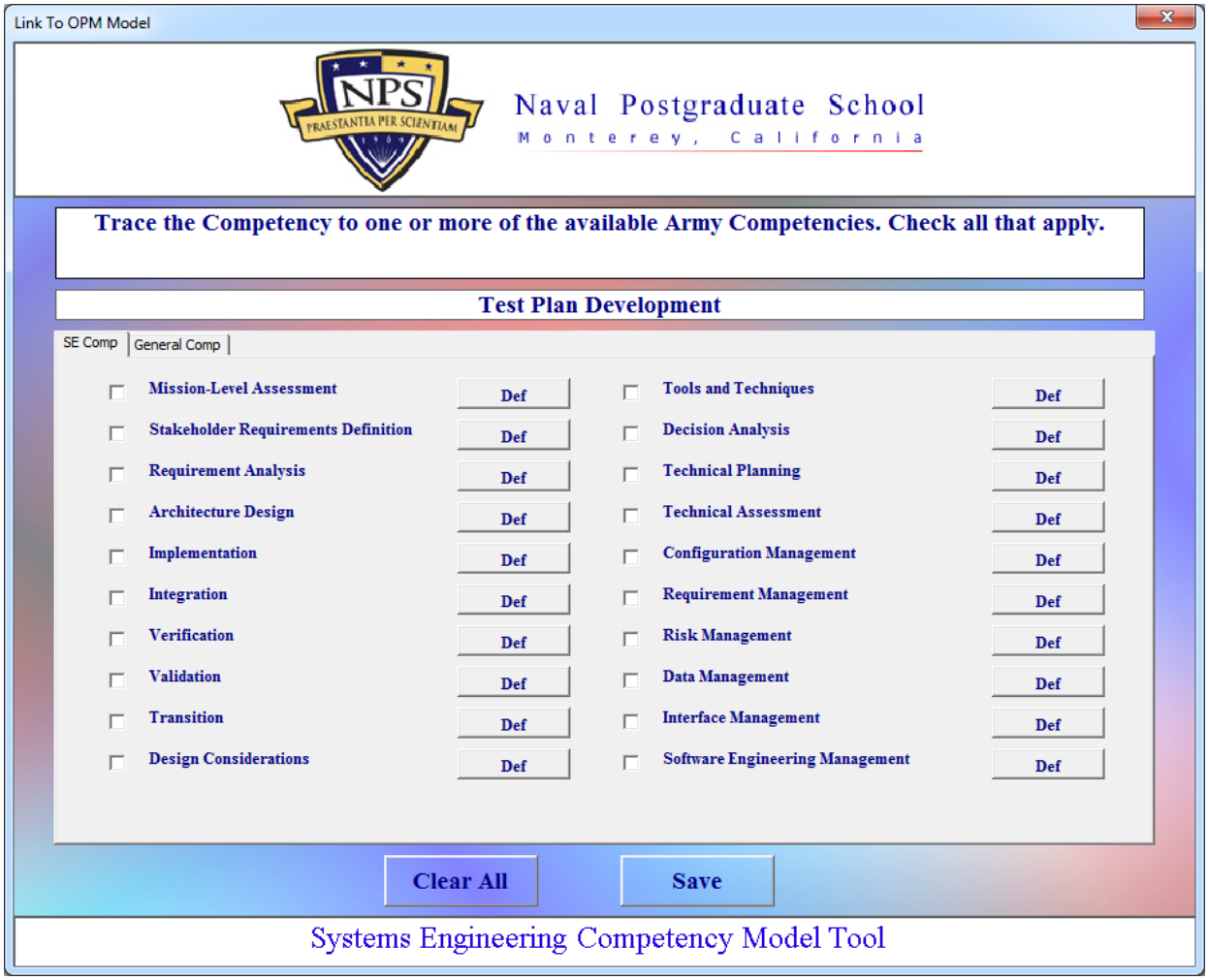


Figure 27 Link New Competency to OPM

The user selects the appropriate OPM competencies and selects the Save button to complete adding the new local competency to the base model as shown in Figure 28.

COMPETENCY LEVEL ASSESSMENT

Entry level ⟷ Journeyman level ⟷ Greybeard SME

Save | Close

Add New Competency

	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	OPM Core Comp.
SEP Development Remove Competency	DAU trained	Read at least SEPs	Written a section within a SEP	Written multiple sections within a SEP	Wrote a SEP	Wrote multiple SEPs	Technical Planning
Risk Management Remove Competency	DAU trainted	Read OSD Risk Guidance	Tracked a risk from genesis through mitigation plan	Developed section of a Risk Management Plan	Wrote Risk Management Plan and been through a Risk Review Board	Been Risk Leadand memeber of a Risk Review Board	Risk Management
Test Plan Development Remove Competency	DAU trainged	Read a Test Plan	Written a section within a Test Plan	Written multiple sections within a Test Plan	Wrote an entire Test Plan	Wrote multiple Test Plans	Verification, Validation

Note: Level accomplishment is indicated by simply highlighting the corresponding cell
Note: Each subsequent Level of accomplishment presumes accomplishment of every prior level descriptors

Figure 28 New Local Competency Added

After the model is updated, the user selects ‘Save’ to save the model and then can select ‘Close’ to close the current displayed model. Upon selecting ‘Close’, the Welcome Screen is displayed.

3.3 Updating Employee Model

By selecting the 'Update Employee' button, Figure 29 is displayed.

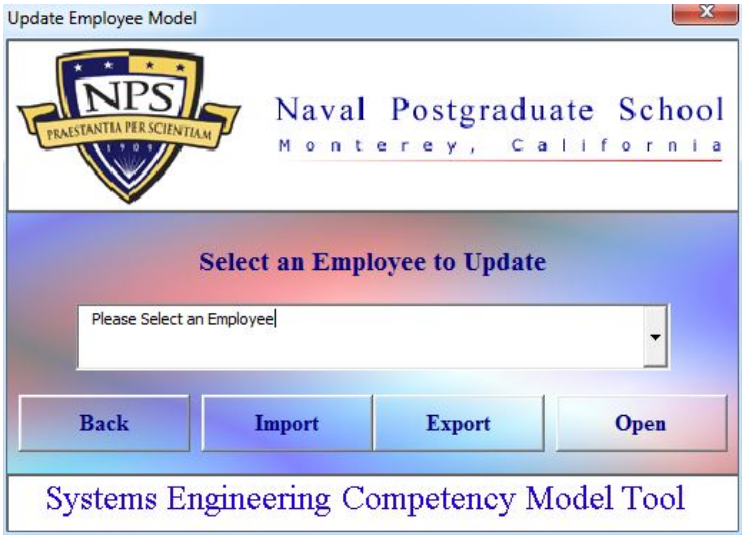


Figure 29 - Update Employee Model

The user can update an employee model in one of two ways. The first way is to open the model and update it in a similar fashion as the base model. To accomplish his, the user select the Open button after selecting the employee model to update as shown in Figure 30.

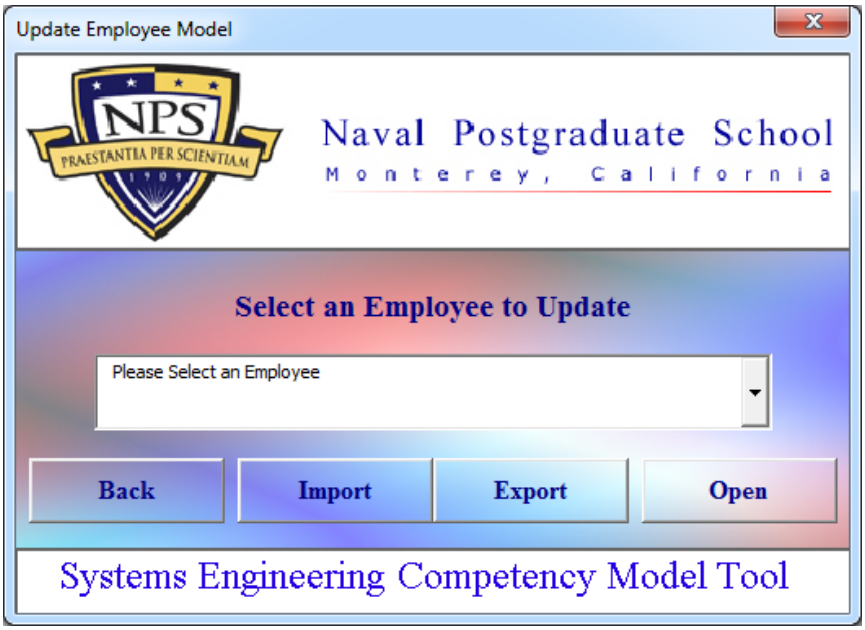
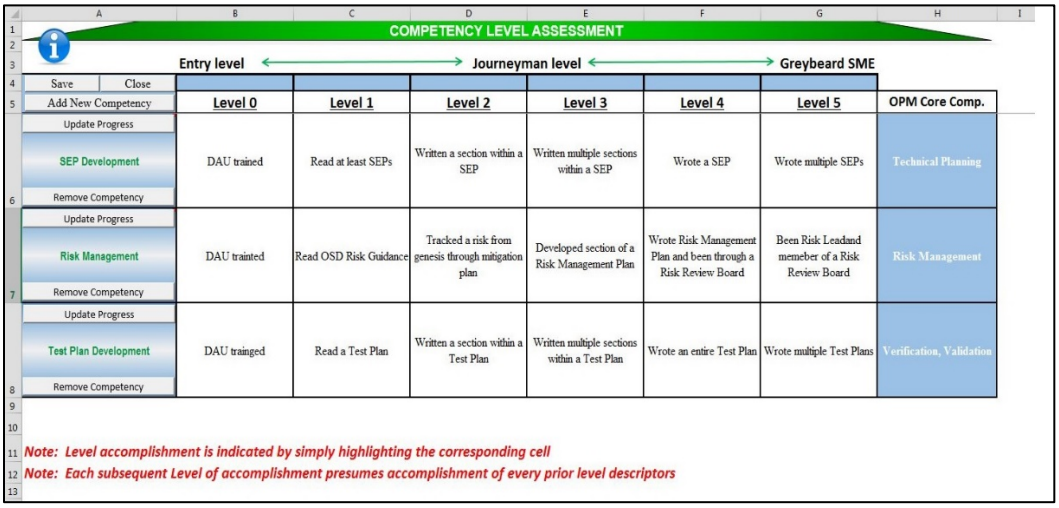


Figure 30 - Select Employee to Update

Clicking the ‘Open’ button reveals the complete model, as shown in Figure 31.



COMPETENCY LEVEL ASSESSMENT

Entry level ⟷ Journeyman level ⟷ Greybeard SME

Save | Close

Add New Competency

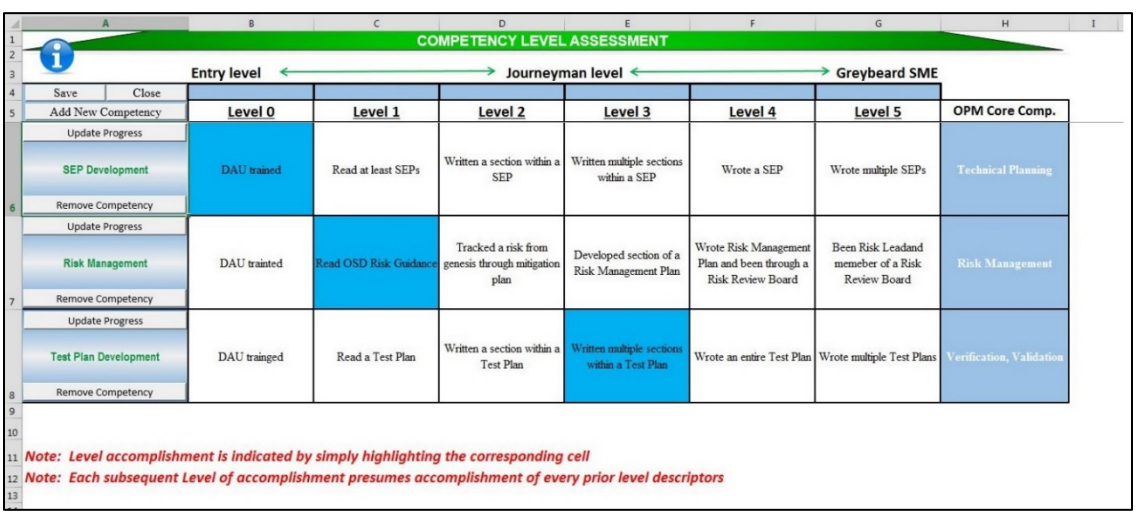
	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	OPM Core Comp.
Update Progress / SEP Development / Remove Competency	DAU trained	Read at least SEPs	Written a section within a SEP	Written multiple sections within a SEP	Wrote a SEP	Wrote multiple SEPs	Technical Planning
Update Progress / Risk Management / Remove Competency	DAU trainted	Read OSD Risk Guidance	Tracked a risk from genesis through mitigation plan	Developed section of a Risk Management Plan	Wrote Risk Management Plan and been through a Risk Review Board	Been Risk Leadand memeber of a Risk Review Board	Risk Management
Update Progress / Test Plan Development / Remove Competency	DAU trainged	Read a Test Plan	Written a section within a Test Plan	Written multiple sections within a Test Plan	Wrote an entire Test Plan	Wrote multiple Test Plans	Verification, Validation

Note: Level accomplishment is indicated by simply highlighting the corresponding cell

Note: Each subsequent Level of accomplishment presumes accomplishment of every prior level descriptors

Figure 31 - Employee Model

The update options are similar to updating a base model with the additional option to update progress via the Update Progress button. By selecting the Update Progress button for a particular Competency, the user can highlight a level for that competency. Highlighting a level signifies that the employee has reached that level for that particular competency. Figure 32 shows Employee #1 progress being updated.



COMPETENCY LEVEL ASSESSMENT

Entry level ⟷ Journeyman level ⟷ Greybeard SME

Save | Close

Add New Competency

	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	OPM Core Comp.
Update Progress / SEP Development / Remove Competency	DAU trained	Read at least SEPs	Written a section within a SEP	Written multiple sections within a SEP	Wrote a SEP	Wrote multiple SEPs	Technical Planning
Update Progress / Risk Management / Remove Competency	DAU trainted	Read OSD Risk Guidance	Tracked a risk from genesis through mitigation plan	Developed section of a Risk Management Plan	Wrote Risk Management Plan and been through a Risk Review Board	Been Risk Leadand memeber of a Risk Review Board	Risk Management
Update Progress / Test Plan Development / Remove Competency	DAU trainged	Read a Test Plan	Written a section within a Test Plan	Written multiple sections within a Test Plan	Wrote an entire Test Plan	Wrote multiple Test Plans	Verification, Validation

Note: Level accomplishment is indicated by simply highlighting the corresponding cell

Note: Each subsequent Level of accomplishment presumes accomplishment of every prior level descriptors

Figure 32 - Update Employee Progress

The second option the user has to update an employee model is by exporting and importing an updated model. The user can select to export the selected employee model. The employee model is exported to a separate Excel file. That file can then be sent to the employee for modification. After the modification has been mode, the model can be imported back in and replaces that previous version of the employee model.

The user first selects the Export button. The user is presented with the file name and location of where the exported employee model is saved to via the message shown in Figure 33.

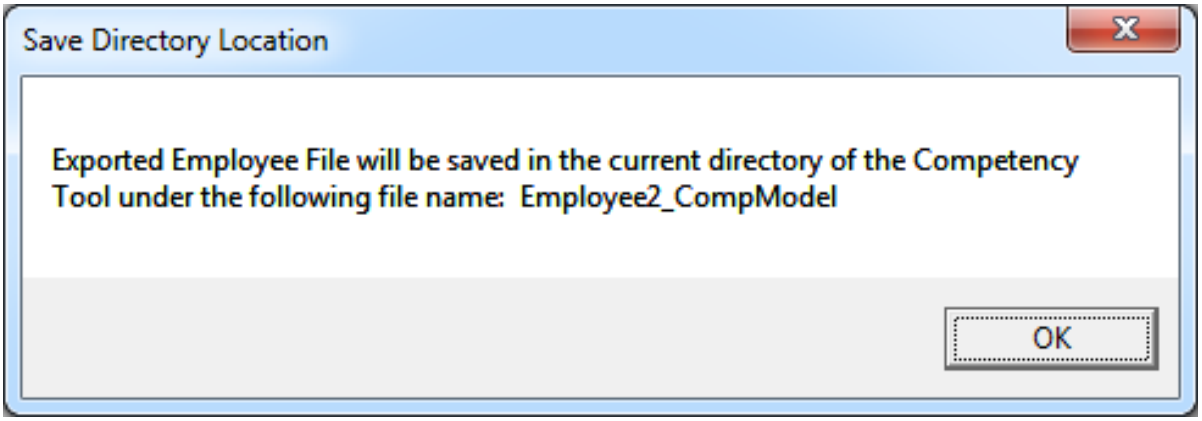


Figure 33 - Save Location

When the user exported model has been updated and is ready for import, the user selects the Import button. By selecting the Import button, the user is presented with a directory browser as shown in Figure 34.

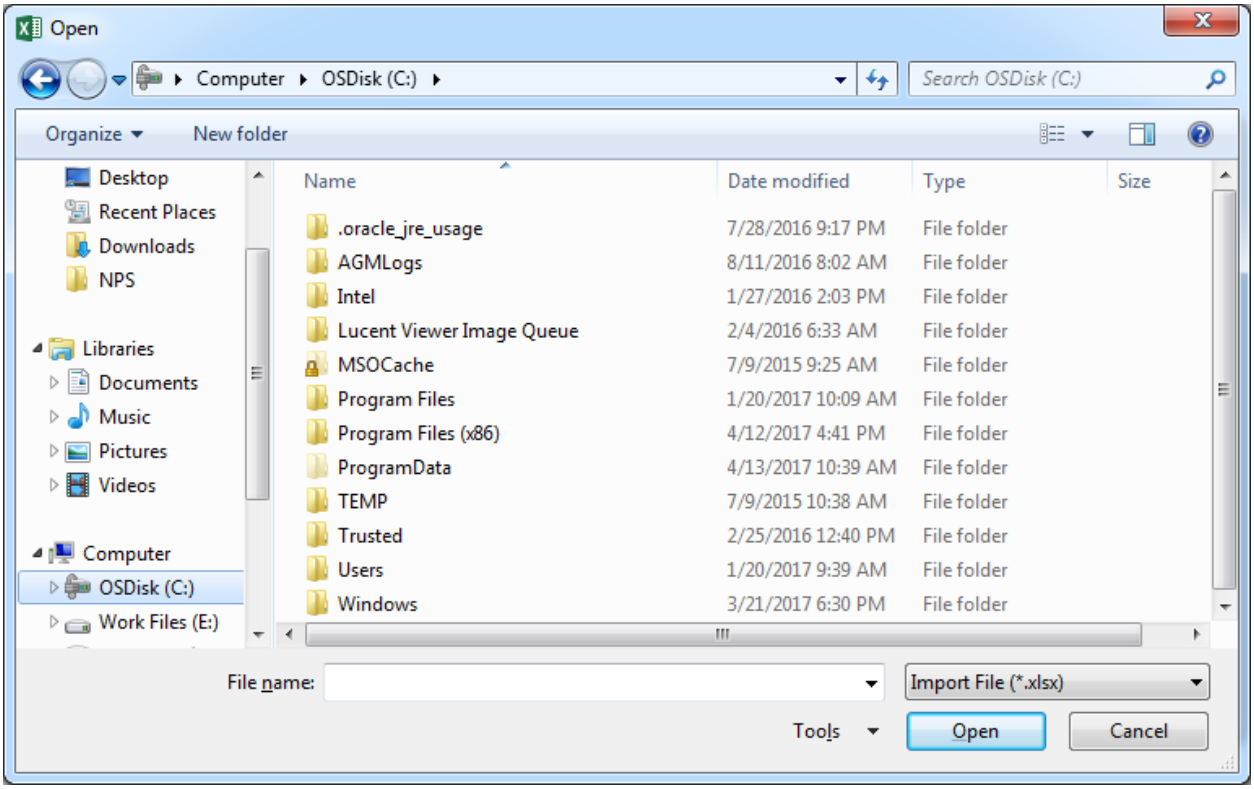


Figure 34 - Import Browser

The user browses to the location of the desired employee model to import and selects the Open button. Upon selecting the Open button, the selected file is copied into the Redstone SECCM Tool and replaces the previous version of the model.

4.0 Metrics

Charts can be developed based on metrics generated by the Redstone SECCM Tool. Supervisors can easily track the progress of individual employees and/or their division by generating a chart. By selecting the 'Metrics' button on the Welcome menu show in Figure 35, the Metrics form is displayed as shown in Figure 36.

Figure 35 - Welcome Screen

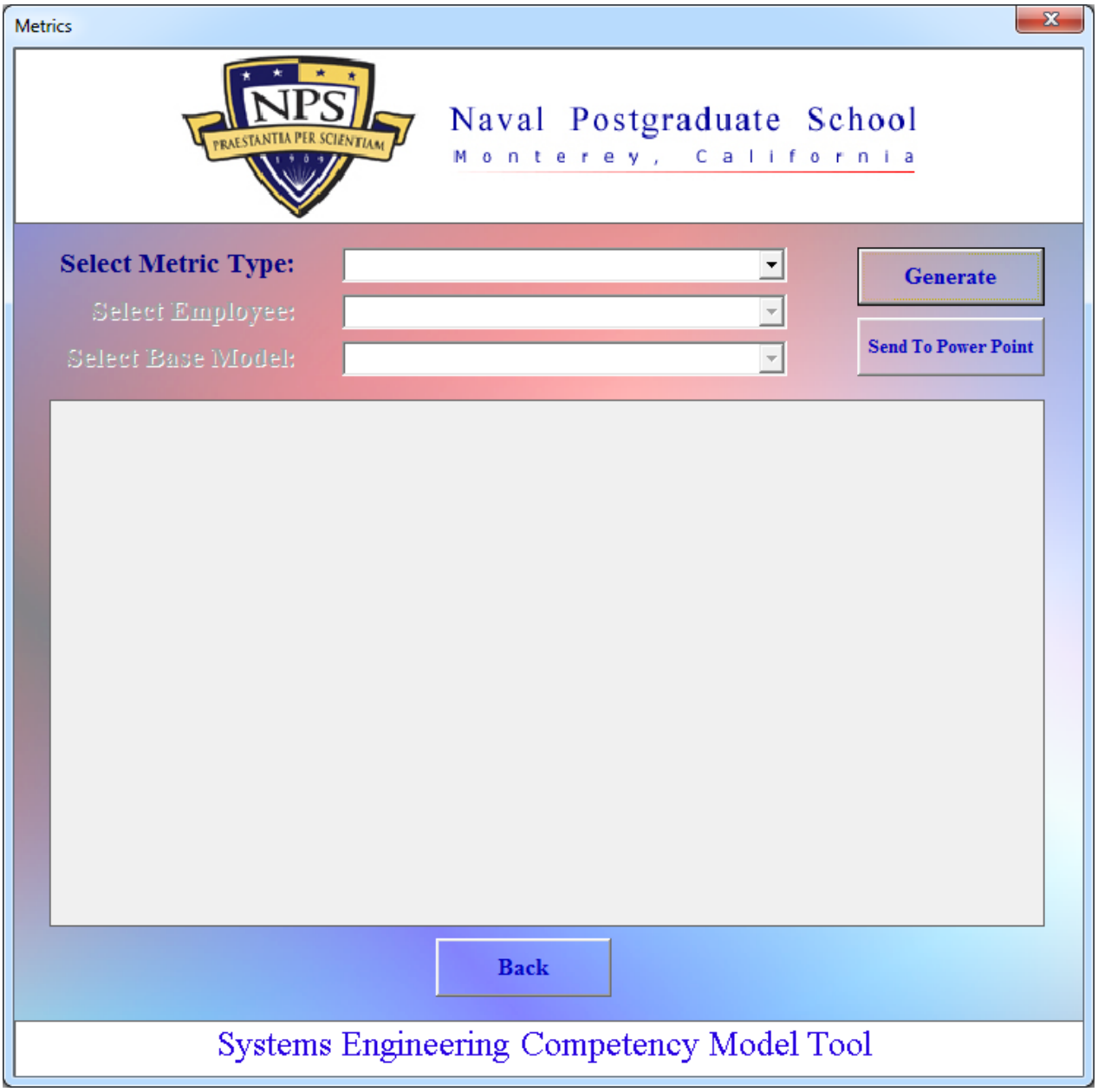


Figure 36 - Metrics Screen

Select the 'Metric Type' combo box to choose the type of metric chart to generate. Figure 37 shows 'Employee Status' being selected as the metric type.

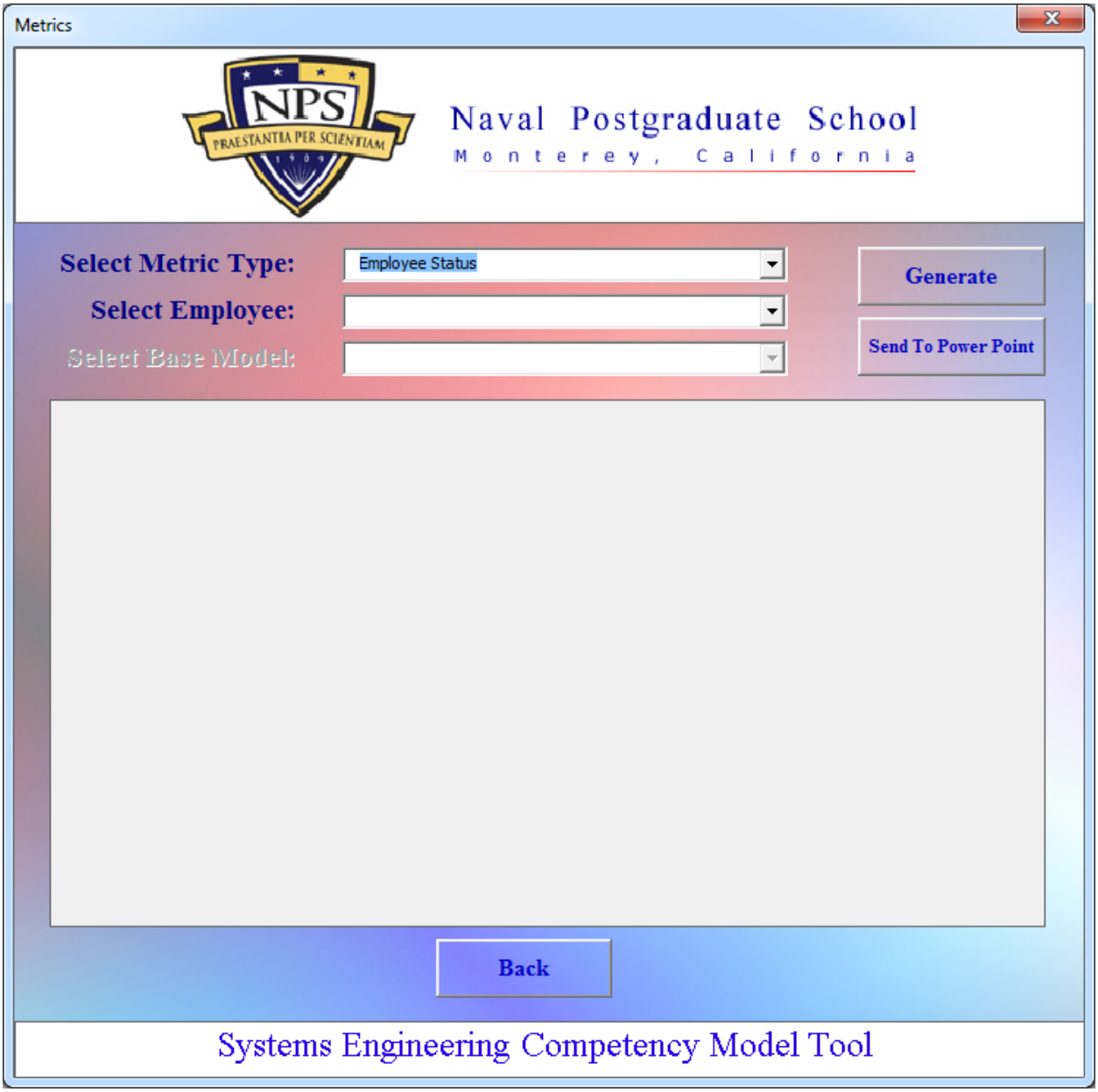


Figure 37 - Select Metric Type

After the metric type is selected, the Employee combo box may become active if metric type is scoped for individual employees. If the metric type is a summary roll-up, the Employee combo box will not become active. If the Employee combo is active, select the desired employee. Figure 38 shows Employee #1 being selected.

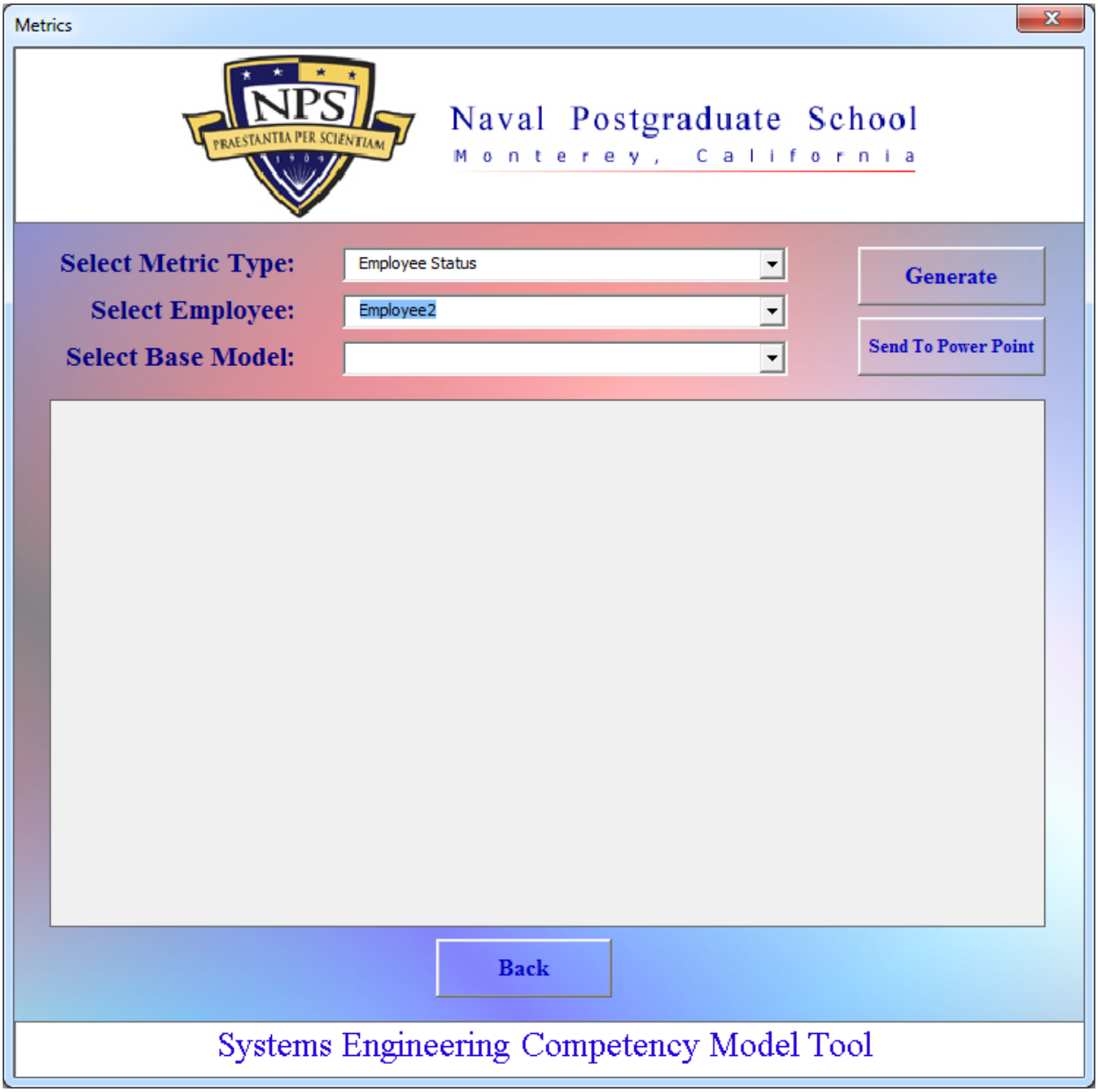


Figure 38 - Select Employee

After selecting an employee, the 'Base Model' combo box will become active. Each employee is connected to at least one base model. Some employees may be selected to multiple base models and thus this requires that the desired based model be selected. Figure 39 shows the base model called New Model #1 being selected.

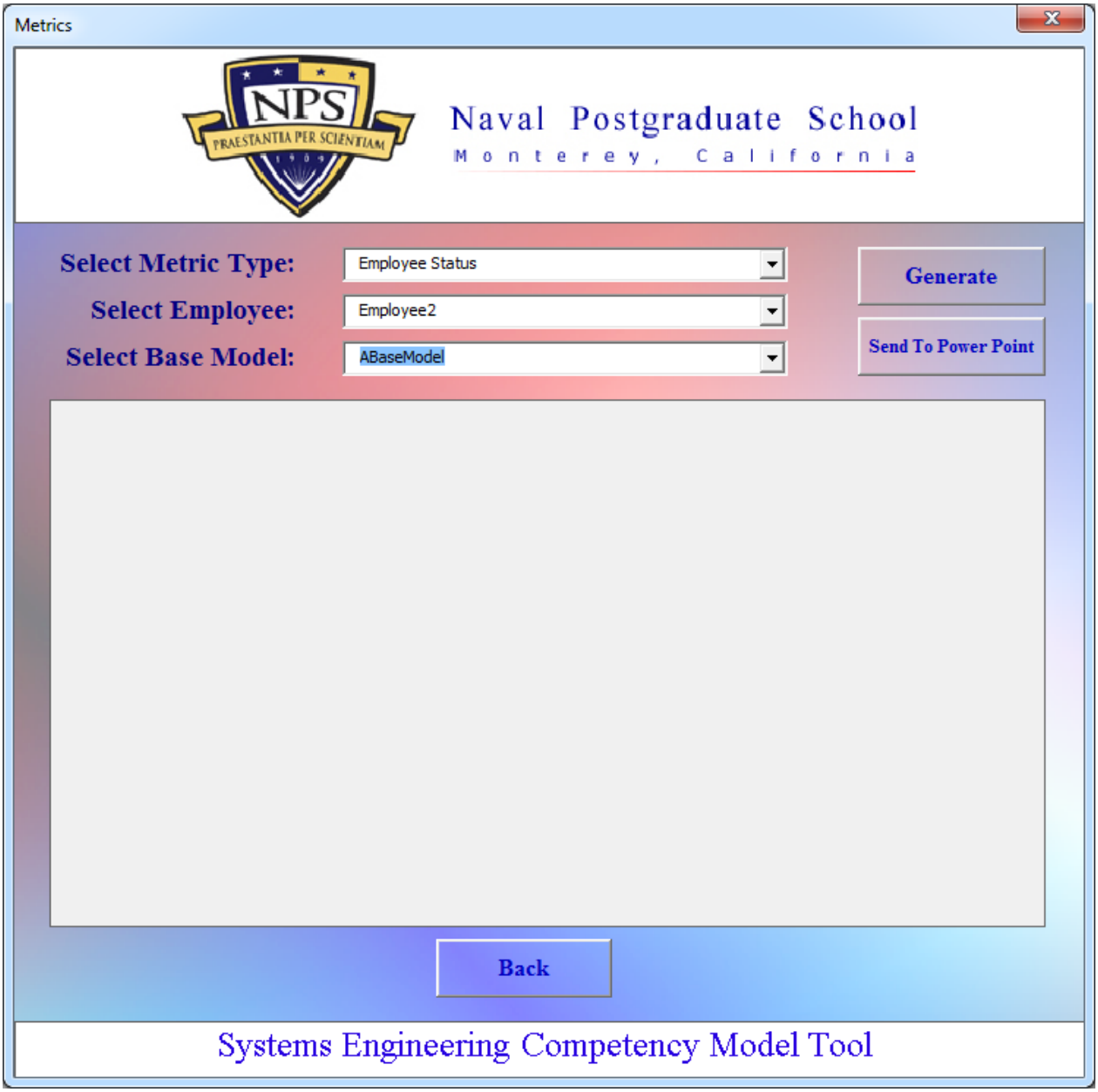


Figure 39 - Select Base Model

After the appropriate information has been selected, select the ‘Generate’ button to create the chart. Figure 40 shows the generated chart for Employee #1 Status.

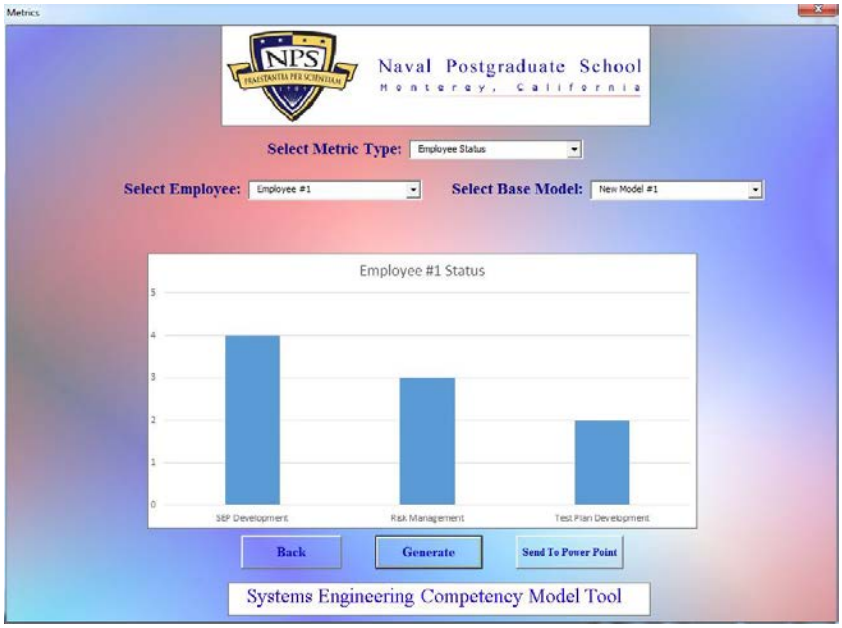


Figure 40 - Employee Status Chart

By selecting the ‘Send To Power Point’ button, the generated chart is sent to a new Power Point file, shown in Figure 41, which the user can edit for a desired state.

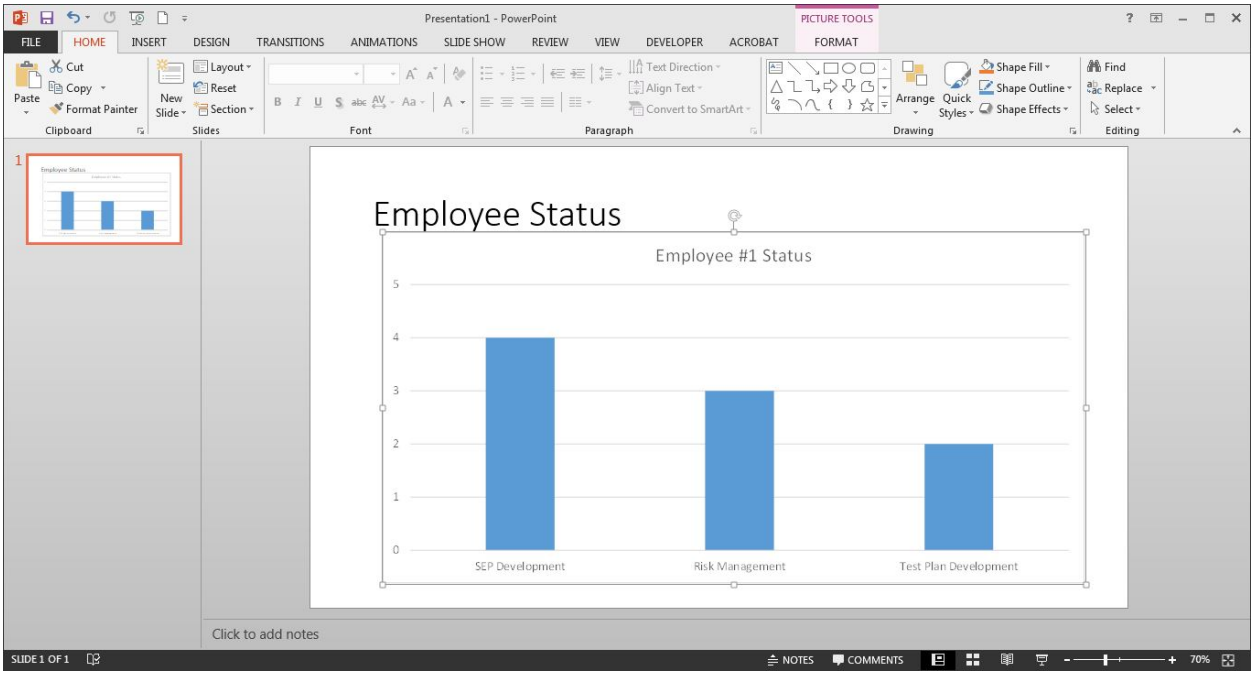


Figure 41 - Chart Exported to Power Point

5.0 Other Considerations

The Redstone SECCM Tool described in this guide meets some, but not all, of the needs identified by the stakeholders in the AMRDEC, PEO MS, and the AMC organizations (see section 1.3 Redstone Systems Engineering Career Competency Model Development Tool). During both the design session and as the tool was being developed, ideas were brainstormed and selected that were intended to meet the needs of the users. Based upon time to implement and the overall program schedule, achievable functionality was placed into the development schedule and non-attainable functionality was identified as a future consideration. Future functionalities include: moving the Redstone SECCM Tool into a mobile software application, building a local competency model via a top-down approach, allowing supervisors to set local competency levels so their employee can become more competitive for promotions, and building in metrics that track competencies at the organizational level.

The capability to assess individuals or organizations over time is a need expressed during follow-on interviews. This information has the added benefit of allowing a manager to identify trends within their organization. Another consideration that would benefit the user is the ability to assess individuals or organizations graphically. Presenting this information graphically, expressed as a need by several stakeholders, is an important future capability under consideration.

5.1 Implementation

The Redstone SECCM Tool is a foundational model that any DOD organization can use as a resource to describe competencies and related work tasks needed for the proficient execution of systems engineering functions. Upon implementation, the Redstone SECCM Tool will allow users to identify and manage critical competencies and tasks for systems engineers at the GS-07 to GS-15 grade levels.

The Redstone SECCM Tool described in this guide provides users with the ability to manage an individual or an organization at the local level. The Redstone SECCM Tool also allows management to objectively measure the status of an individual or organization and is tailorable to meet the existing or future needs of the user.

6.0 Changes to the User Guide

Updates and changes will become the responsibility of the end users at their discretion and will not be managed centrally after initial submittal.

7.0 Redstone SECCM Tool Development and Updates

Updates and changes will become the responsibility of the end users at their discretion and will not be managed centrally after initial submittal.

8.0 Reference Documents

The following reference documents form the framework for the general and technical systems engineering processes developed during this Capstone Project:

Defense Acquisition Guidebook. (n.d.). *Defense Acquisition Guidebook*. Washington, DC.

U.S. Office of Personnel Management (OPM). 2016. *Army Occupational Analysis of the Systems Engineer Position.* Washington: U.S. Office of Personnel Management.

International Council on Systems Engineering (INCOSE). 2015. *INCOSE Systems Engineering Handbook.* 4th ed. Accessed March 25, 2017. http:\\www.incose.org.

International Organization for Standardization (ISO) 15288. 2015. *Systems and Software Engineering — System Life Cycle Processes*. Geneva, Switzerland: ISO.

Whitcomb, C. 2016. *SE320X Systems Conceptualization, Design, Implementation & Operation A Design Thinking and Human-Centered Design Approach*. Naval Postgraduate School. Monterey, CA.

Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)). 2015. *Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics.* DOD Instruction 5000.02. Washington, DC: Under Secretary of Defense (AT&L), January 7.